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SAUGEEN

CONSERVATION REPORT

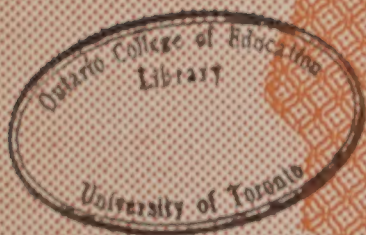
of that part of the saugeen valley including and above the town of walkerton

DEPARTMENT OF PLANNING AND DEVELOPMENT

LAKE
HURON

SAUBLE

SYDET



WITHDRAWN

MAITLAI

BIGHORN

HORN

BEAVER

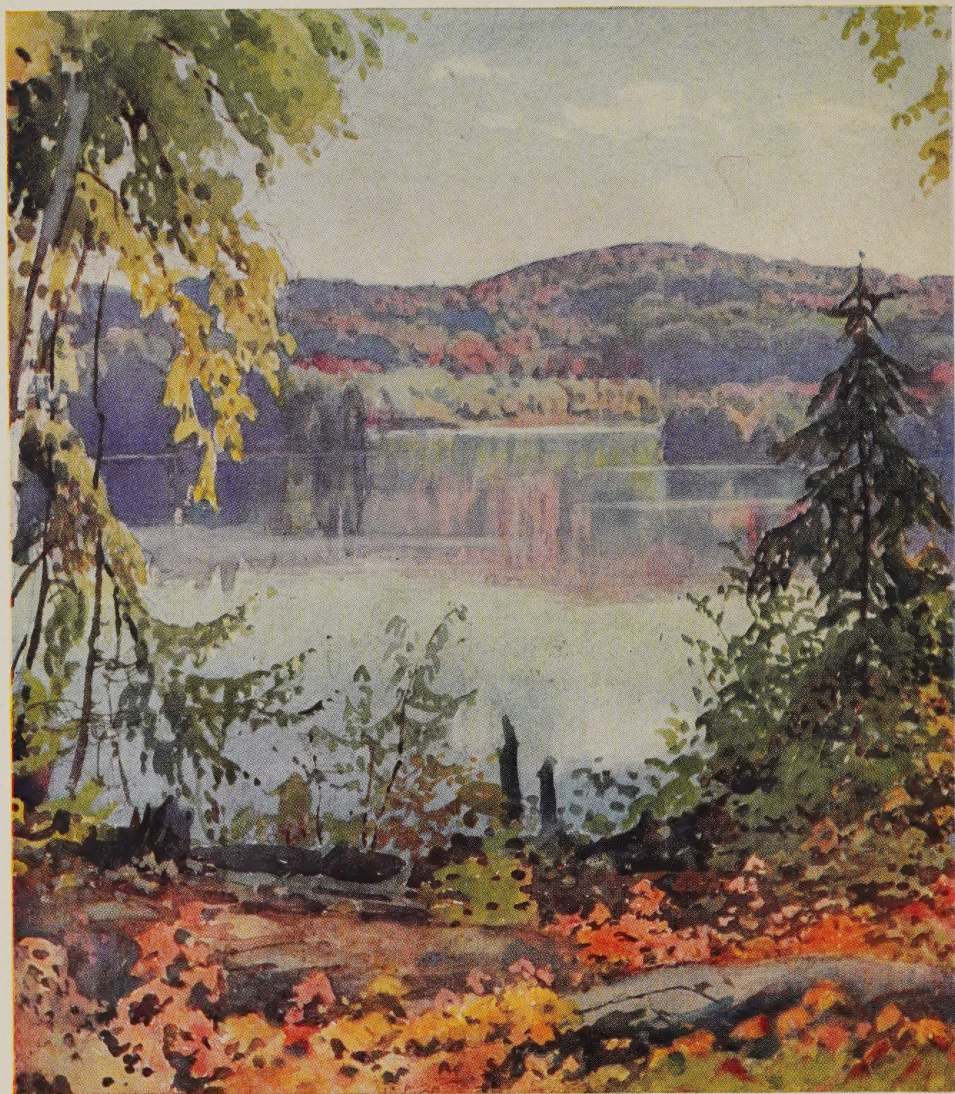
UPPER
SAUGUEN
CATCHMENT

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From a watercolour by F. H. Brigden, R.C.A., O.S.A.

THE LAKES, HILLS AND VALLEYS OF THE
ROCKY SAUGEE ARE WELL SUITED
TO FORESTRY

Department of Planning and Development

HON. W. K. WARRENDER, Minister

A. H. RICHARDSON
Chief Conservation Engineer

CAZON

ER 57

- 528185

UPPER SAUGEEN VALLEY CONSERVATION REPORT 1953

SUMMARY



ONTARIO

TORONTO

Printed and Published by Baptist Johnston, Printer to the Queen's Most Excellent Majesty

1953

WITHDRAWN

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INTRODUCTION

Conservation has long been a subject of concern to the people of Ontario. This concern had to do originally with the protection of forests because of their importance as a source of revenue to the Province; but allied with this was the problem of wildlife management and the protection of source areas of rivers and streams. In Southern Ontario interest in conservation was indicated first by reforestation and woodlot management, but more recently this has broadened out to include flood and pollution control, improved land use and provision for recreation facilities.

While the progress in these activities has been steady up to the present, most of the programs heretofore were initiated by government departments. Recently, however, there has been a growing conception of personal obligation, especially where land use problems, farm ponds and small reforestation projects are concerned. On the other hand, control of flooding, summer flow and pollution, and large reforestation projects have come to be considered the responsibility of the community—the community in this case being the river valley.

With the advent of this new concept of personal and community responsibility in conservation, the Authorities movement was born, and the willingness of our people to undertake conservation in this way is indicated by the fact that in the last six years 15 Authorities have been established, with a total membership of 256 municipalities and an area of 10,505 square miles.

The first step in establishing a Conservation Authority is undertaken by all the municipalities wholly or partly within a watershed. Two such municipalities must first by resolution petition the government to call a meeting for the purpose of ascertaining whether or not an Authority should be established. Two-thirds of the number of representatives which the municipalities are entitled to appoint (on a population basis) must be present to make the meeting legal. If two-thirds of those present vote in favour of establishing an Authority a resolution is forwarded to the government. The Authority is then established by Order-in-Council and under the Act becomes a body corporate, including representatives from all the municipalities in the watershed.

While most of the Authorities were brought into being because of flooding within their areas, all were aware of the necessity of carrying out such supplementary measures as improved methods of land use, reforestation, proper woodlot management, prevention of pollution, investigation of underground water supplies, wildlife studies and recreation. But the Authorities were not equipped to carry out the extensive investigations that would indicate where such work should be done. Consequently the Conservation Branch of the Department of Planning and Development undertook to carry out the preliminary investigations as a service to the Authorities, to appraise, by means of surveys and reports, the conservation needs of each watershed, and to submit to the Authority in question a detailed report outlining the conservation measures that should be followed.

The survey work is grouped under five general headings: Land Use, Forestry, Hydraulics, Wildlife, and Recreation. The scope of the studies made in each of these subjects varies with the condition and needs of the area under investiga-

tion, with the result that in the completed report the findings recorded for each subject are related to the problem involved. In addition to the five conservation topics indicated above, a study covering the history of the area is incorporated. This serves as a backdrop to the whole conservation problem of the watershed and compels the reader to understand the abuses of the past and the need for a diversified program in the future.

The starting point for all surveys is aerial photography; in preparation for the work which has been done on each of the fourteen watersheds covered to date, the area was first specially photographed. Before the survey is commenced in the field all such contributing data as maps, old records, photographs, unpublished reports and other useful information are thoroughly explored and recorded. While the survey is in progress similar data are gathered locally, and agricultural representatives, zone foresters, municipal clerks, other officials and private citizens are interviewed for additional material.

The results of these conservation surveys, together with the recommendations based upon them, are set down in the reports presented to the Authorities and intended to serve them as a blueprint. The carrying out of any scheme is not the work of the Conservation Branch of the Department of Planning and Development, which is not an operating department. Its active participation ceases when the planning is complete and the report is submitted, although it stands by to interpret the report and give advice and assistance in carrying out the plans recommended to the Authorities. The Authority must assume responsibility for initiating the schemes which it considers most urgent; it must also make approaches to the government departments or other bodies from which it hopes to get assistance.

If, for example, an Authority undertakes a scheme having to do with land use, it must seek assistance from the Department of Agriculture; if it involves a forestry or wildlife problem, then the Department of Lands and Forests is approached. In the case of flood control, however, as there is no department of the government doing hydraulic surveys except the Conservation Branch, whose staff is not large enough to carry through the engineering works of several Authorities, the Authority must engage a consulting engineer to do the final engineering and designing and to carry the work through the construction stage. Similarly, where an Authority undertakes a scheme which has to do with recreation, it must employ men specially trained in this work.

As the work being done by Authorities is a new approach to the conservation problem, in that the responsibility of carrying it out is left entirely in the hands of the Authority concerned, much directing and assistance have been necessary from the Conservation Branch, and in the case of five Authorities, a member of the staff of the Department of Planning and Development has been assigned to work in the watershed.

The Saugeen Valley Conservation Authority was established by Order-in-Council on March 16, 1950, following an organization meeting which was held at Walkerton on November 8, 1949, when 31 representatives out of a total of 38 attended the meeting and 27 voted in favour of establishing the Authority.

During the summer of 1951, as a service to the Authority, the Department of Planning and Development conducted a conservation survey on that part of

the watershed which may be described as the Upper Saugeen, and included the river at Walkerton and the watershed above that point. It was not possible in one season to survey the whole Saugeen Watershed, so that a part was selected which is well suited to reforestation as well as other types of conservation work. It is planned to survey the remainder of the watershed in the near future.

The full report on the Upper Saugeen, in mimeographed form, was presented to the Authority by the Honourable William Griesinger, Minister of Planning and Development, at a public meeting held in Walkerton on November 26, 1952. It was pointed out by the Minister that the full report was intended as a working plan, chiefly for members of the Authority and other officials, and that the edition was limited to 190 copies. However, as there is much information of general interest in the full report, it has been the practice of the Department to publish in printed form a summary of the large volume for distribution to the people of the watershed to acquaint them with the plans which it is hoped the Authority will implement in the years that lie ahead. This present edition, numbering 3,000 copies, will be distributed widely throughout the Saugeen Watershed.

— A. H. R.

The Saugeen Valley Conservation Authority

Established by Order-in-Council March 16, 1950

IRWIN LOBSINGER.....Chairman
GEORGE MANNEROW.....Vice-Chairman
A. H. RICHARDSON, P.Eng.....Chief Officer
ALEX SIEGFRIED, Walkerton.....Secretary-Treasurer

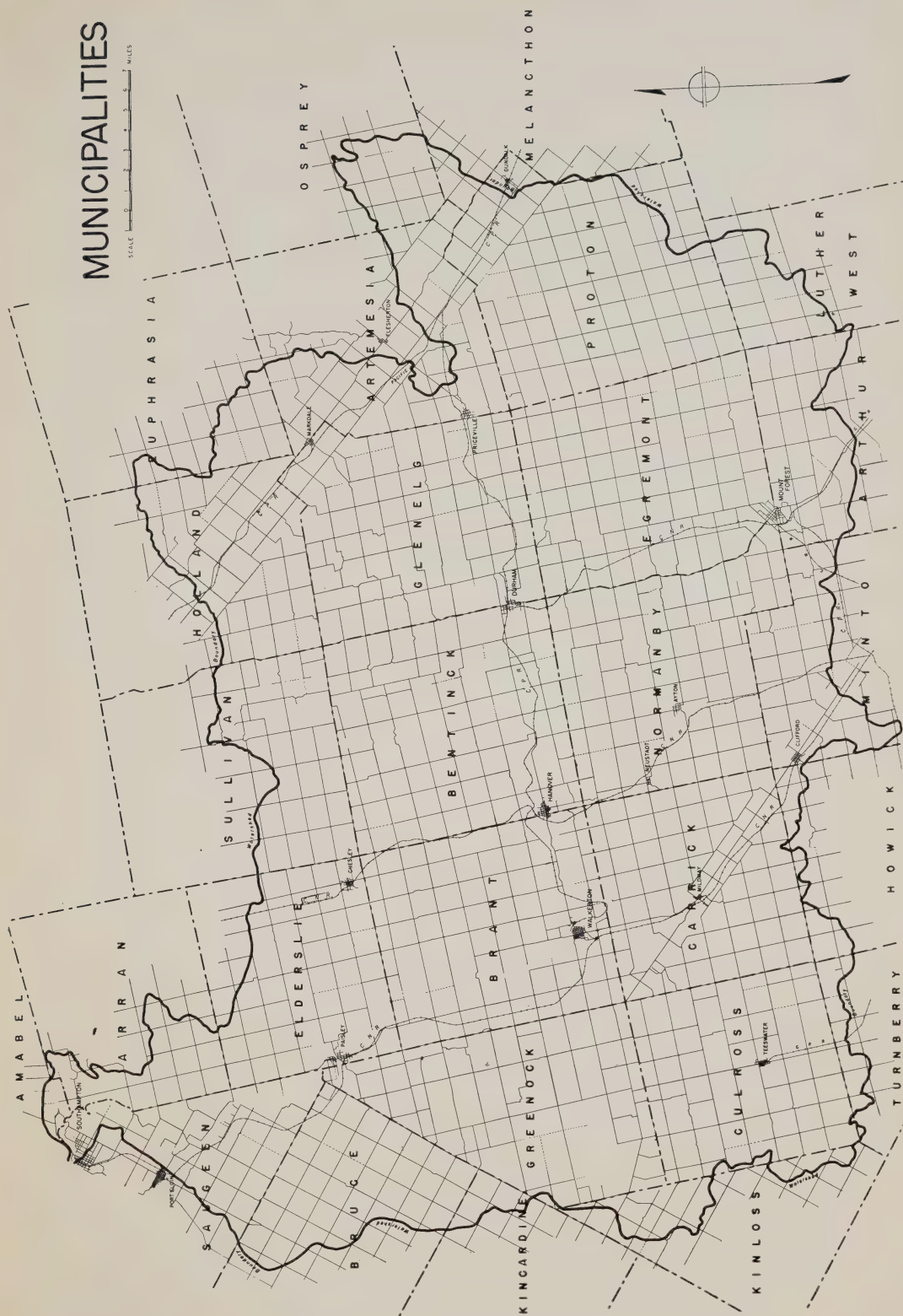
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RUSSEL McFADDEN*.....Arran Township
JOHN A. DAVIS*.....Artemesia Township
ED. WHITE.....Arthur Township
GEORGE MANNEROW*.....Bentinck Township
WALTER CHISHOLM*.....Brant Township
ELWOOD HOWE.....Bruce Township
ALFRED WALTERS*.....Carrick Township
HOWARD KRUG.....Chesley Town
EDGAR ECKENSWILLER*.....Clifford Village
JOS. A. McINNES.....Culross Township
ARTHUR C. NEFF.....Durham Town
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ROSS WAGNER*.....Elderslie Township
RUSSEL FREEMAN.....Euphrasia Township
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WILBERT SUTCLIFFE.....Holland Township
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A. A. McKINNON.....Saugeen Township
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JULIUS E. KUHL*.....Sullivan Township
A. H. McTAVISH.....Teeswater Village
THOS. H. ABRAHAM.....Turnberry Township
IRWIN LOBSINGER*.....Walkerton Town

*Member of Executive Committee

MUNICIPALITIES

SCALE 0 1 2 3 4 5 6 MILES



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University of Western Ontario

Recommendations

Stated or Implied in This Report

HISTORY

1. That where records, buildings and objects exist of sufficient interest as illustrating the life of the watershed during the period of development, the preservation of these relics be considered an aspect of conservation; and that where such records and other relics are the private property of individuals and corporations within the watershed, the Authority take definite measures to encourage their preservation by their owners or their commitment to proper care in libraries, museums, archives and other suitable repositories.
2. That when sites or buildings of this kind form part of, or are closely adjacent to, properties acquired by the Authority for flood control, reforestation or recreation, the possibility of including them in the scheme be considered.
3. That in such cases sites be marked and buildings preserved and used for some purpose in connection with the project compatible with retaining their original character.
4. That, before carrying out any project, the Authority ascertain from the Department of Indian Archaeology of the University of Western Ontario whether the area concerned is likely to contain archaeological material and if necessary arrange for the investigation of the site before operations make this difficult or impossible.

5. That a marker be placed on Highway No. 6 at the point, about three miles north-west of Mount Forest, where the line of Rankin's survey of 1837 of the Garafraxa Road diverges from the line of the present road; and that a similar marker be placed at the point, about three and a quarter miles west of Durham, where Rankin's line of 1837 crosses the present Highway No. 4.
6. That markers be placed to indicate the site of some of the earliest mills, churches, taverns, etc., in various parts of the watershed, as, for example, on Hunter's Hotel in Durham; Edge's Mill (now McGowan's) in Durham; Valentine's Mill at Paisley; and the Indian sawmill of 1844 near Southampton.
7. That from the small number of sites and buildings of historic interest (in the wider sense used in these recommendations) to be found within the watershed, a few be selected for eventual inclusion in the scope of the activities of the Authority, besides those connected with recommended projects.
8. That wherever possible, the buildings be left on their original sites and continued in their original use or adapted to some suitable purpose in connection with the normal life of the community.
9. That the Authority provide as part of its recreation program an area or areas where buildings which it is desired to preserve may be re-erected when they cannot be retained on the original site.
10. That some of these buildings be used to house collections of objects of domestic, agricultural and industrial use and of pictures and documents illustrating the history and development of the area.
11. That in selecting the limited number of buildings and objects that can be preserved in this manner, care be taken to choose those that best illustrate the development of the area, without undue regard to age, association or artistic merit.

LAND USE

12. That the Authority give leadership in promoting methods of land use designed to control erosion and water loss.
13. That the program of land use for conservation of soil and water include improvement of long-term pastures, crop rotations with emphasis on soil-building crops, and the establishment of grassed waterways on all intermittent watercourses.
14. That land suitable for long-term pasture which lies beside Authority forests be acquired, improved by the Authority and made available to neighbouring farmers as a self-supporting project and as a demonstration of good land use.
15. That an experiment be set up in the area known as the Dundalk Silty Plain to determine the possibility and advantages, if any, of tile drainage on this land type.
16. That the Authority enlist two or more co-operators to adopt methods of erosion control, contour strip-cropping, diversion terraces, grassed waterways, and vegetative methods, to demonstrate these practices in the area.
17. That the Authority choose one tributary watershed of about 30,000 acres and through a Land Use Advisory Board develop a Valley Plan to show how land can be improved; further, to give direction and assistance in co-operation with other government agencies in establishing soil and water conservation methods on individual farms.
18. That the Authority arrange technical and material assistance in the creation of farm ponds where usefulness and feasibility can be shown.

FORESTRY

19. That the Saugeen Forest be established and that it be expanded through a definite program of annual additions and planting until the total area of 30,028 acres is acquired and reforested.

20. That the Authority expropriate all land suitable for reforestation purposes subject to the regulations of The Municipal Act as and when such lands become tax delinquent.
21. That the the Authority set up a committee to determine the best methods of providing fire protection for wooded areas within the watershed in co-operation with the Department of Lands and Forests.
22. That the Authority encourage the establishment of natural regeneration in and close to existing woodlands by instructing landowners in methods of scarifying soil and breaking sod immediately preceding the dispersal of seed by parent trees. This should be done in early September for most species and early June for elms and soft maples.
23. That the Authority inaugurate a scheme to aid farmers in fencing their woodlots from cattle. This would enable regeneration to establish itself, restore the spongy cover of leaves and humus over the soil and improve the water-holding capacity of the soil itself.
24. That the policy of aiding landowners to reforest marginal land be expanded by the Authority. The Authority already furnishes a tree-planting machine with tractor and operator for a nominal sum and also subsidizes planting on land too rough, too steep and too wet for machine planting.
25. That the Authority purchase a portable wood chipper which would be made available to farmers in the same way as the tree-planter. This could be used to clean up low-grade hardwood and weed trees in woodlots. The chips can be used in place of straw for cattle bedding and chicken litter and spread on the fields as humus. In some cases it may be possible to sell such chips to pulp companies.
26. That the Authority support the Provincial School Forestry Competition and 4-H Forestry Clubs by enlisting the help

of co-operators, providing transportation where necessary and special recognition of winners.

27. That the Authority request the Department of Lands and Forests to require all log buyers who purchase logs from Southern Ontario woodlots to publish their log-grade specifications, together with prices offered.
28. That the Authority set up a committee to publicize the following among woodlot owners and sawmillers, where necessary:
 - (a) The advantages of replacing the present system of custom sawing by an arrangement whereby credit is given for "custom logs", and against this credit the farmer receives, at preferred prices, the species, quantity and quality of product best suited to his needs.
 - (b) Lists of buyers who are interested in the purchase of woodlot products. These may be obtained from the Zone Forester.
 - (c) The advantages of soliciting tenders from as many buyers as possible who are within economic operating distance of the woodlot.
 - (d) The advantages and disadvantages of lump sum sale and stumpage rate sale.
 - (e) The benefit of having a written Timber Sales Contract for timber on the stump. It is recommended that the Advisory Board, in co-operation with the Zone Forester, prepare a suggested form of contract.
 - (f) The arguments in favour of having experienced loggers do the cutting and the owner handle small products, such as fuelwood, posts and bolts.
 - (g) That the marking of trees for removal is a technical operation vital to the future of the woodlot, and that it should only be done by the Zone Forester or other trained personnel.

- (h) The importance of having the woodlot appraised prior to selling the farm.
- 29. That the Authority make direct representation to the Department of Finance of the Federal Government in support of the recommendation in the Report of the Select Committee on Conservation (1950) that "the Dominion Government should be asked to consider amending the Dominion War Tax Act so that landowners will no longer be penalized for cropping their timber in accordance with conservation practices".
- 30. That the Authority use its influence to have assessment revised so that land only is assessed, not the timber growing on it, and that the municipality concerned recover its revenue by means of a severance tax imposed at the time the timber is cut.

WATER

- 31. That the channel improvement work and dike as recommended in the report prepared by the Kilborn Engineering Company Limited be carried out.

WILDLIFE

- 32. That the Authority encourage farmers to improve their land for wildlife by the elimination of grazing of woodlots, by selective cutting in woodlots, by improved cultivation practices and by the planting of wildlife food patches.
- 33. That the introduction of fish into the watershed be restricted to those parts of the river shown on the map "Biological Conditions of Streams" (which accompanies the full report) to be suitable for the species concerned.
- 34. That the Authority encourage owners and lessees of parts of the Saugeen River to improve them for fish by installing low dams, deflectors and other devices for producing good fish cover.

35. That fishing clubs and individuals be encouraged to organize a creel census by keeping records of the hours of fishing, the number and lengths and, where possible, scale samples of all fish taken and to make the records available to the Department of Lands and Forests so that the best methods of management of streams for trout can be worked out.
36. That the Conservation Authority sponsor a demonstration of improvement of a trout stream for fish; alternatively the Conservation Authority might urge a demonstration of stream improvement on one of the trout streams in the Grey County Forest.
37. That the Conservation Authority use its powers to stop the dumping of sawdust into the Saugeen River.
38. That the Conservation Authority encourage farmers to construct or improve farm ponds for fish.
39. That the Conservation Authority inform all those operating dams for power on the Saugeen River of the importance of adjusting the flow of the river so that it is reduced below the dams as little as possible.
40. That the Conservation Authority consider the possibility of acquiring, or at least urging the acquisition of, a stretch of the Rocky Saugeen for public fishing.

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I

HISTORY

CHAPTER 1

THE INDIAN PERIOD

Recorded history in the peninsula of Western Ontario begins with the coming of the white man. To the French trading posts on the St. Lawrence River had come Indians from various tribes, and among them the Hurons, "so called by the French because they wore part of their hair standing straight up like bristles on a wild boar. Their own name was Ouendat or Wyandott". From what he could learn of their location, numbers, state of culture and influence, Champlain concluded that it was desirable to cultivate their friendship. In the year 1613 he brought to Canada several missionaries, one of



whom, the Recollet Father Le Caron, he sent to the country of the Hurons to establish a mission. Champlain's interest in establishing the Huron Mission was political as well as religious; he was setting up an outpost in furtherance of the cause of France in North America. Father Le Caron's purpose was to convert the savages to Christianity. In Champlain's view it was equally important to control the Huron fur trade, and to win the Hurons to side with the French against the English. Thus, in September 1615, he not only visited the Huron Mission with gifts of persuasion and good-will, but even accompanied a Huron war-party on an expedition against the Iroquois.

The expedition ended in disaster for the Hurons. Setting out from Cahiagué, at or near the present Orillia, the war party paddled down the Trent River to Lake Ontario and crossed over into the enemies' territory. They were repulsed, and late in October returned to Cahiagué, nursing their resentment. Champlain remained with them through the winter.

From the western shores of the Penetang peninsula one could look out across the waters of Nottawasaga Bay to where the massive outline of the Blue Mountains showed like a barrier against the setting sun. The mountains, Champlain learned, were the western limits of the Huron territory; beyond them lay the Tobacco Indians, whose country reached to a great lake still farther to the west. "The Tobacco Nation was so called because they were growers of that article. Their Indian name was Tionnantates, their French name Petun."* Champlain determined to visit them.

Accordingly, in January 1616, Champlain and Le Caron, accompanied by their interpreter, Étienne Brûlé, set out on their visit to the land of the Petuns. There is no record of the course of their journey, but it is said that they visited seven Petun villages and that they received a warm welcome. And this is, so far as we know, the first time that a white man set foot in the country which is drained by the Saugeen River.

In May, 1616, Champlain returned to Quebec. He left behind him in the west a situation tense with the rancour of smouldering rivalry that was thirty years later to break out into a savage war of extermination. Champlain's share in the Huron expedition against the Iroquois had stirred in the latter a sense of bitter hostility. The Huron monopoly of the fur trade and the increasing scarcity of beaver furs in the Iroquois country brought dissatisfaction and hatred into the Iroquois councils. Their efforts to persuade the Hurons to share the fur trade proved ineffectual. The trade increased; the Hurons prospered; and the Iroquois determined grimly to destroy the Hurons. The storm of their fury broke in the winter of 1648-49, when "a large band of enemy warriors infiltrated into the Huron country and with masterly strategy isolated and destroyed the settlements one after another". In vain the French missionaries sought to show the Hurons their danger and to persuade them to prepare their defences. The Hurons lacked the political acumen of their enemies; they not only failed to match and meet the strategy of the Iroquois, but even,

*James, C. C. *The Downfall of the Huron Nation*. O.H.S. P. & R., VIII: 314. 1908. The name Petun for tobacco is derived from a South American word for that plant. *Petunia* is a further derivative. The word "hure", according to *Harrap's Dictionary*, means: (a) a shaggy, tousled head; (b) the head of a boar.

by ill-advised and ill-directed raids on the country of the Ojibways and Ottawas, estranged those tribes that were by tradition and treaty their friends.

By 1649 the Iroquois had completely devastated the Huron country and had driven the remnants of the Hurons and all their allies out of the Huron peninsula. On the maps of the ensuing century the former Huron country is designated merely "the beaver hunting grounds of the Iroquois".

The wretched remnants of the Hurons fled across Georgian Bay to the country about Lake Superior, and appealed to their ancient allies the Ojibways and the Ottawas for assistance and revenge.

While the exiled Hurons were thus pleading their unpromising cause with the Ojibway chiefs, the Ojibway hunters prosecuted a lively trade in furs with the French at Montreal. About the year 1652, the Iroquois, who resented the protection that the Ojibways had extended to the Hurons, attacked and murdered several Ojibway trading parties at various points along the French River-Ottawa line of communication. The Hurons seized the occasion to renew their arguments for revenge against the implacable Iroquois. The immediate result, however, was not war, but a Council of Peace, in which Ojibways met Iroquois in Iroquois country at the mouth of the Saugeen River, and there concluded a treaty of peace which, it was soon evident, the Iroquois did not intend to keep.

At this time the Hurons began to accompany the Ojibway traders to Montreal. This became added provocation to the Iroquois who saw "that the French were more friendly to the Indians of Lake Superior than they were to them; and that the Ojibways were a protection to those by whom they were formerly molested". The treaty was broken, and once again the Iroquois attacked a party of traders on the Ottawa River.

What the Hurons had been unable to achieve by their persuasions, the Iroquois had brought about by their perfidy. The Ojibways determined to make a war to the death against the Iroquois, and the remaining Hurons welcomed the opportunity to seek revenge. To a dozen tribes the call went out, dwellers by the shores of Lakes Superior, Huron, and Michigan; and from the north and west and south the allies of the Ojibways answered the call. When all was ready, a fleet of no less than seven hundred war canoes gathered on Lake Huron and struck the enemy with overwhelming force.

The first fierce battle took place, ironically enough, at the mouth of the Saugeen River, at the scene of that Council of Peace where the treaty had been concluded whose violation was the cause of the war. It was now the turn of the Ojibways to carry raid after raid into the Iroquois' country. Battles were fought on Lake Simcoe, at Rice Lake, at Mud Lake, at Pigeon Lake, and at the mouth of the River Trent. This was another "war of extermination", and with varying intensity it continued through nearly forty years. Indian wars on a large scale were no swift campaigns. They had a beginning, but no apparent end.

The Ojibway-Iroquois war could not be waged apart from the alliances of the contestants with the French and the English. Denonville, the Governor of Canada, proposed in 1686 the establishment of two French posts, one at Detroit and the other at Toronto: "These two posts will block the passage against the

English should they attempt to go again to Michilimaquina and serve as retreats for our Indian allies either while hunting, or while making war against the Iroquois". Governor Dongan, of New York, sent a succession of trading expeditions "with a large party of sixty men" to buy furs at "Missilimakina", and the French disarmed the second of these expeditions and allowed the Indians and French to pillage their goods. So far as Ontario was concerned, hostilities came to at least a temporary end in 1687, when Denonville led a war party of some four hundred canoes against the Senecas, cleared the north shore of Lake Ontario of the last of the "castles" of the Iroquois, and built a fort at the mouth of the Niagara River.

Between the French and the English, and between their respective allies, the struggle went on; but in this struggle the Huron peninsula no longer played a conspicuous part. The events of the eighteenth century affected Boston, New York, Quebec, Montreal, Albany, Niagara, and Detroit; but from the Saugeen country there were no reports and no news. Even the fall of Quebec in 1759 and the ensuing transfer of all French territory in Canada to the English gave no occasion for any mention of the remote region between Georgian Bay and Lake Huron. When the Saugeen reappears in written records we find it a country occupied by settled bands of Ojibway (Chippewa) Indians, or of their allies, the Mississaugas, the Pottawatamies, and the Ottawas. The tribal wars of the Indians have passed, some into legend, some into history; and an era of permanent occupation, settlement, and survey by the "English" of Upper Canada has begun.

CHAPTER 2

SETTLEMENT

In 1791 Canada was divided into the two provinces of Upper and Lower Canada. Within the next ten years, the lands bordering the St. Lawrence River, Lake Ontario and Lake Erie had been laid out in counties, and more than a hundred townships had been named and surveyed in the chequer-board pattern that the Government had adopted. The significance of Lake Huron as the western boundary of Upper Canada was recognized, and communications with its vast extent had been established by way of Lake Simcoe and Georgian Bay as well as by way of Lake St. Clair. Of the lands that lay between Burlington Bay and Lake Huron little was known until after 1820. In 1792, the surveyor Augustus Jones carried an exploratory expedition into the country traversed by branches of the Grand River, with instructions to run a line "from the outlet of Burlington Bay, W. end of Lake Ontario, to the River Thames, formerly called the River La Tranche". His course from Burlington Bay ran north-west for fifty miles, bringing him to a point less than two miles short of the present village of Arthur; here he turned south-west, and then south in his search for the Thames. Jones had missed the Saugeen by eleven miles.

The surveyors explored one by one the rivers of Upper Canada, and laid off townships along their several courses. Between 1791 and 1797, most of the Thames and Grand Rivers had been traversed. In 1804 William Hambly surveyed the "Chaniel Ecartie", the Sydenham River of South-western Ontario.



Log house west of Irish Lake, Glenelg Township.



Stone farmhouse about two miles north of Durham, on the east side of the Garafraxa Road (Highway No. 6).

Between 1827 and 1835, Mahlon Burwell, John McDonald, and David Gibson opened the Huron Road from the present New Hamburg to the mouth of the Maitland River, now Goderich, laid out townships on both sides of the road, and ran the line that divided the Canada Company Tract from the vast blank space to the north, marked "Indian Lands".

During the War of 1812 there were only two posts on Lake Huron that were regarded as of sufficient importance to call for fortification, namely Michilimackinac and Matchedash Bay. Vessels of both sides sailed the waters of Lake Huron, but appear to have had no occasion to put in at the mouth of the Saugeen River. Indeed, it is probable that few, if any, of the navigators of 1812-15 were aware of the existence of the Saugeen. Very literally, the Saugeen was not yet on the map.

It was in 1822 that Captain Henry W. Bayfield of the Royal Navy made the first survey of the upper Great Lakes and prepared the first chart of Lake Huron. The chart shows the mouth of the Saugeen River and its course (with no great attempt at accuracy) for a distance of two or three miles inland. Near the mouth, on the north bank of the river, Bayfield shows a small village, marked "Indian Traders". But he is chiefly concerned with the interests of navigation; the legend reads: "River Saugink, 6 feet over the bar it becomes shoal and rapid 200 fms. within the entrance". Nearly thirty years later, in the late autumn of 1850, the surveyor Robert Lynn observed the effects of a severe storm on the mouth of the Saugeen, and wrote in his diary:

"examined the Mouth of the River, and came to a candid conclusion that the Mouth of the River Saugeen were Impracticable for making a permanent Harbour, at any reasonable expence."

In the meantime, the people of Upper Canada had begun to display an interest in the spiritual welfare of the Indians in various parts of the province. Missions were established at the mouth of the Credit River, at Muncey Village on the Thames, and in the vicinity of Detroit. In 1829, the Rev. Peter Jones, son of the surveyor, Augustus Jones, and of Tubenahneequay, his Mississauga wife, was one of a party of seven preachers who visited the Saugeen Indians, "from whom they first heard the Gospel". Two years later the Canada Conference (Wesleyan) Missionary Society established a permanent mission at the mouth of the Saugeen River and placed John Benham, with John Simpson as interpreter, in charge. Arriving at his station April 19, 1831, Benham reported that he was "joyfully received by the few Indians who were here". A few days later, with the help and advice of the Indians, he set about building his house. He had brought with him by boat from Goderich boards for floors, and "doors, window frames and sash already made". From this date forward, the Methodist missionaries, through their schools, through their preaching, and through their participation in the councils of the Indians, exerted a considerable influence on the lives of their charges.

The succession of appointments to the Saugeen Mission and the record of the numbers of church members afford little indication of the disturbing events of the year 1836. In that year the Lieutenant-Governor of Upper Canada, Sir Francis Bond Head, met the Ojibway chiefs in Manitoulin Island, and concluded with them the treaty by which all the Saugeen Territory south of the

*Old church on west side of
the Toronto-Sydenham Road
(Highway No. 10), near
Berkeley, in Holland Town-
ship.*



Anglican church at Durham, built 1878.



Owen Sound-Southampton line was ceded to the Crown. The treaty consists of two separate agreements and was signed on the 9th August, 1836, by Head and his interpreter, and by fifteen Ojibway chiefs.

The Conference of the Wesleyan Methodist Church, meeting in Toronto, June 24, 1837, maintained that the Saugeen Territory had been surrendered by persons who were not the proprietors, and declared further that it was the "deliberate and unanimous decision of the Chiefs assembled from different Tribes that no person should have authority to cede or surrender the Saugeeng Tract without the sanction of General Council and the concurrence of the hereditary and acknowledged Chief". They considered the surrender to be void. Lord Glenelg, Secretary of State for the Colonies, asked Sir Francis Bond Head to answer the charges made in this memorial, and with Head's reply the correspondence closes.

In spite of the protests, the treaty remained in effect, and was followed, in course of time, by further surrenders of Indian lands to the Crown and the vast forest that stretched to the northward from the line of the Canada Company's Huron Tract came to be called the "Queen's Bush".

Following the acquisition of the Saugeen Territory by the Crown, the most urgent need of the area was for roads of access. Hitherto, access to the Saugeen country had been by one of two routes, the Georgian Bay and Lake Huron. Since Champlain's day, by these waters had come explorers, traders, and missionaries; and now to these were added surveyors, land agents, and intending settlers (who anticipated the surveys and "squatted" on the lands of their choice). The Rev. Peter Jones and his party of evangelists, in 1829, had crossed Georgian Bay from Penetanguishene to Owen's Sound, had carried their boats and supplies across the Saugeen Peninsula, and after a brief sojourn at the mouth of the Saugeen River, had gone on by Lake Huron to Goderich and Lake St. Clair, and thence to Toronto. Upon Mr. Benham's appointment in 1831 to the infant mission at Saugeen, he and his interpreter had travelled from the Credit River to Stratford and Goderich, and thence by water to Saugeen. No land route was yet available; to open a good and direct road was a matter of immediate urgency.

The Government instructed Charles Rankin to lay out the line of a road "from Oakville to Owen's Sound". Mr. Rankin in 1833 had laid out the Townships of Collingwood and St. Vincent, on Georgian Bay, and by his choice of a site for his own log house at Lora Bay, just west of the present village of Thornbury, had become one of the pioneer settlers of Grey County. Beginning at the head of Owen's Sound, in 1837 Rankin ran the line of his road through to Garafraxa Township. The Rebellion of 1837 interrupted Rankin's operations, and the greater part of the line he had blazed was never opened. When, in 1840, the Government took the next step toward providing access to the Saugeen Tract, it was to instruct John McDonald to undertake the necessary survey.

The Garafraxa Road was a "free grant" road. That is, the Government offered as an inducement to settlers fifty acres (half a lot) free to each bona fide settler, with the option of buying the remainder of the lot within nine years. At first the vacant half-lots alternated with the occupied half-lots, and all faced the road in a single tier. As a result, the settlers were spaced farther apart



County Registry Office for the Southern Division of Grey County, at Durham, built in 1871.

School house at Edge Hill, Lot 35, Concession III East of the Garafraxa Road, Glenelg Township, built probably before 1870.



than they liked; and it became difficult to maintain the road in front of the vacant half-lots. As further work was done on the road, the Government changed its plan, and in Glenelg and Bentinck Townships located the pioneers on all the half-lots facing the road, giving them the usual option to buy a contiguous half-lot in a second tier. The Garafraxa Road became the chief route by which settlers entered the Queen's Bush.

In their choice of a site for their pioneer homes, many settlers were guided by a desire to "locate" in the proximity of good neighbours, and no farther than was necessary from the more settled communities they were leaving behind them. Thus the tendency was for settlement along the road to develop progressively from either end and to build up at intervals the beginnings of the hamlets and villages where an inn or a mill might be found. Such a village was Mount Forest, called at first "Maitland Hills" because of the erroneous supposition that the stream on which it was situated was a branch of the Maitland River. Such also was Durham, founded by Archibald Hunter in 1842. Hunter had emigrated from Scotland in 1841 and had settled in New York State. Attracted by the offers of free grants to be had in Canada, he and his son William made their way to Oakville, and thence by the Garafraxa Road into the wilderness. At Oakville they were advised to "locate" on the high land that they would find immediately north of the crossing of the "Big Saugeen River". This then became their pitch: Mr. Hunter chose his land on the east side of the road and William took the lot opposite. The first building erected in Durham was Archibald Hunter's log house, in which he passed the winter of 1842-43. Within a year he had brought his family to the new home, and had opened his house to the public as an inn; there was then no other inn between Mount Forest and Owen Sound. In 1854 Hunter built the stone hotel shown on the opposite page.

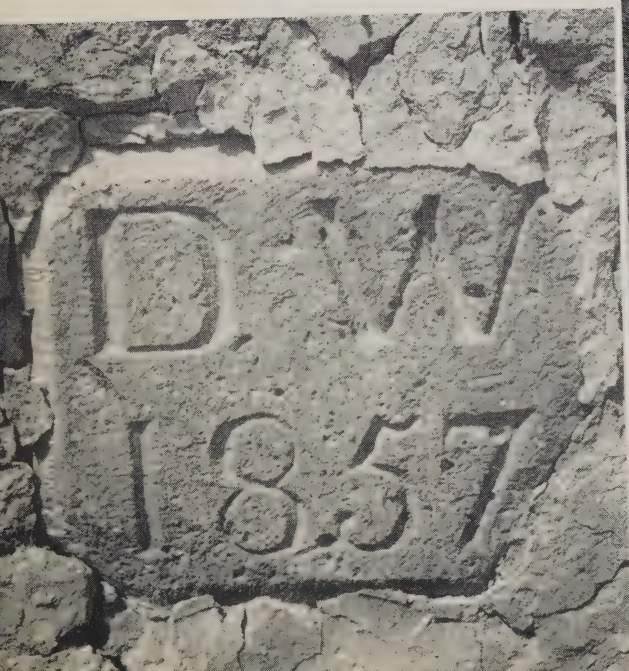
It soon became desirable to open additional roads to the Saugeen, partly as avenues of access, partly as, in themselves, the basis of settlement schemes. In 1848 Charles Rankin began to survey the Toronto-Sydenham Road through the Townships of Artemesia and Holland; and in the same year David Gibson and Allan Park Brough laid out the Durham Road, an east-west line crossing the Garafraxa Road at Durham, and extending ultimately to Lake Huron at Kincardine. Both these roads were "colonization roads", laid out with the intention of making free grants of half-lots to actual settlers, with the option of buying the remaining half-lot; and along both roads the new-comers continued to "locate", while at intervals hamlets grew into villages, and villages into towns. On the Durham Road, Abraham Buck settled at "Buck's Crossing" (now Hanover) and opened his log house as an inn; and Joseph Walker opened an inn at another crossing of the Saugeen River, the beginning of the present town of Walkerton.

Beginning about 1850, travellers found that they could effect an economy in time and effort by going along the Durham Road to Buck's Crossing, and there building themselves rafts or scows by which to continue their journey by water. One of the first to try the water route was Robert Lynn, the surveyor who was instructed to lay out the town plot of Southampton, then called Saugeen. In the course of the next two or three years, the river journey by scow or raft became a fairly frequent undertaking, and for many the experience



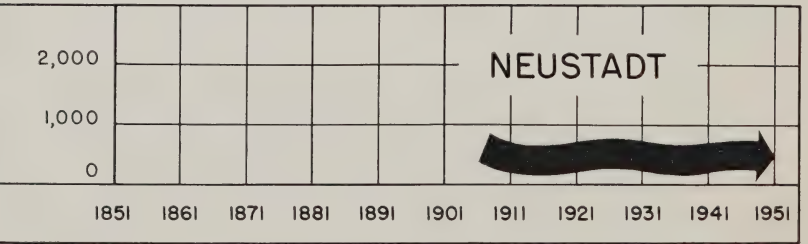
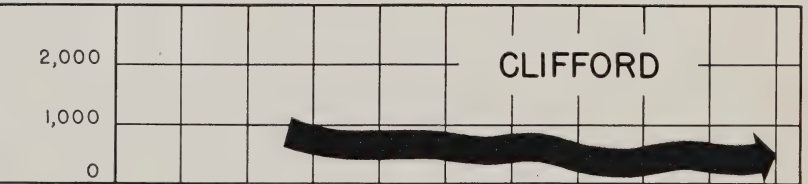
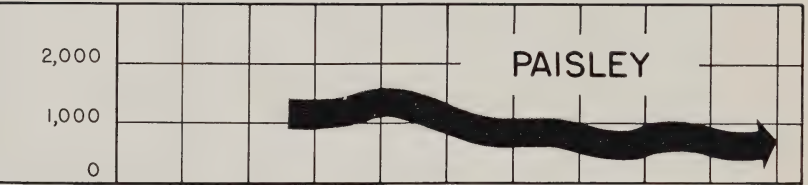
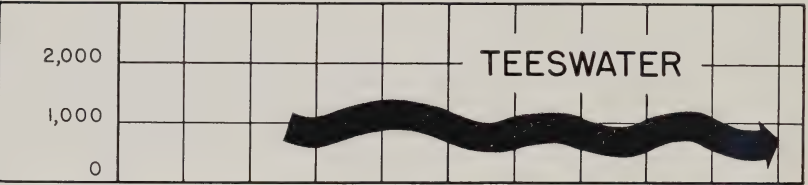
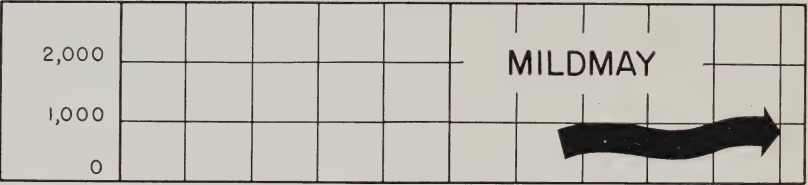
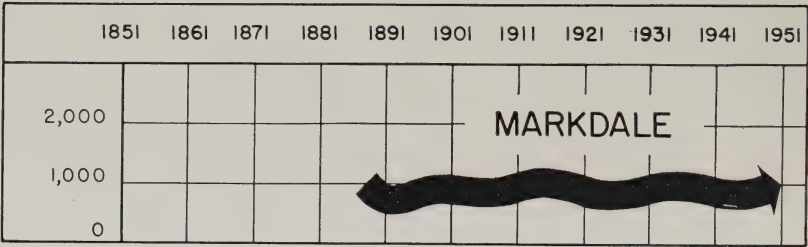
The British Hotel, Durham, built in 1854 by Archibald Hunter (from a photograph made in 1858).

This was the corner-stone in the original grist mill built by David Winkler, in 1857, in Neustadt, on Meux Creek. It now forms (1952) part of the foundation of a modern flour mill on the same site.

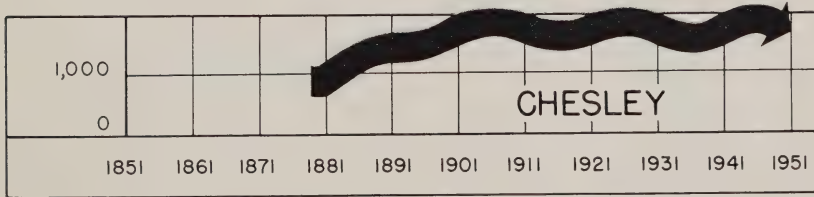
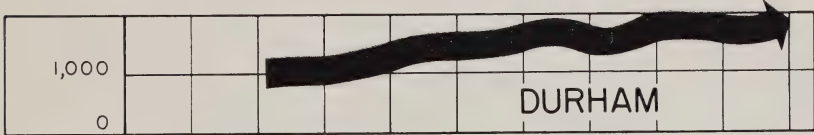
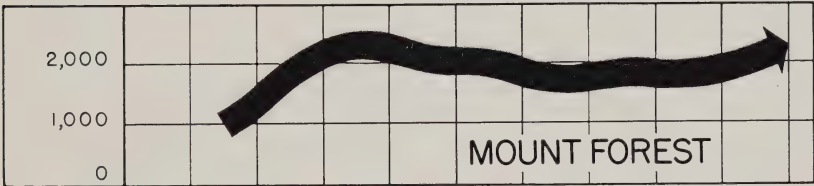
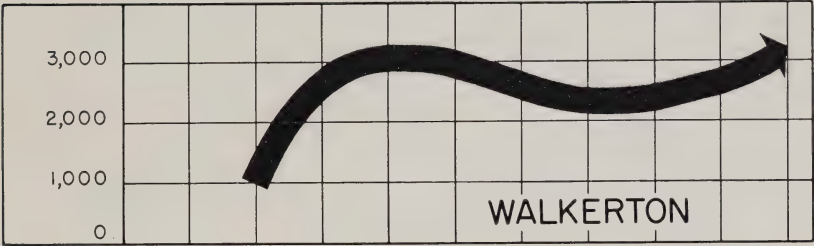
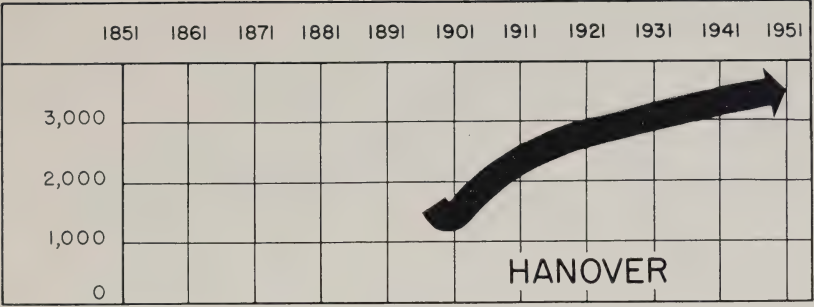


Memorial cairn, at Durham, marking the spot where the first settler, Archibald Hunter, passed his first night, May 1, 1842.

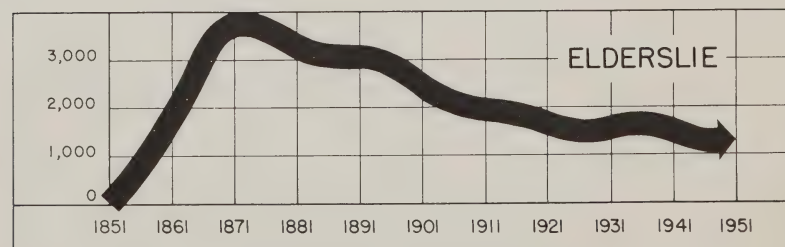
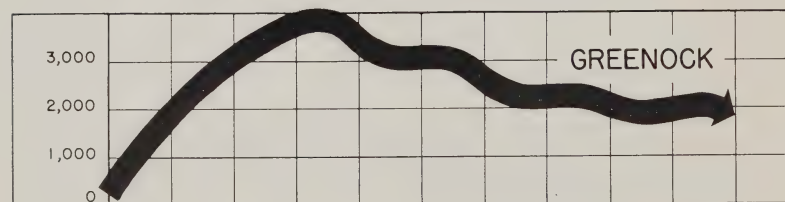
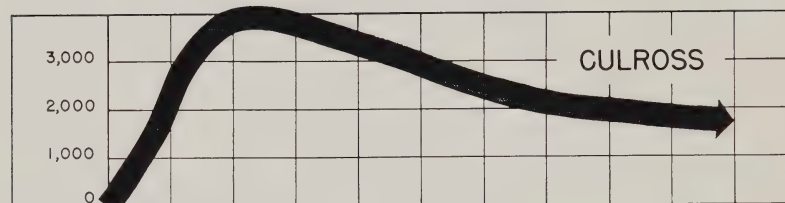
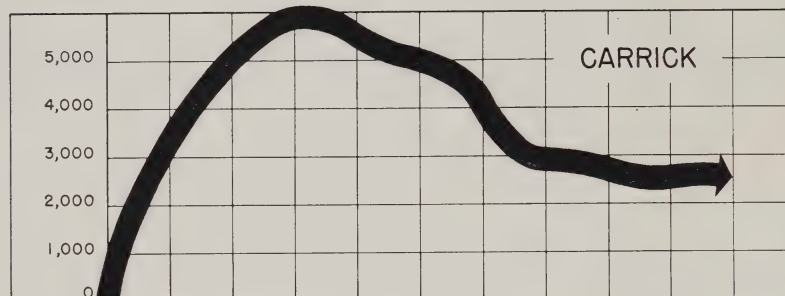




VILLAGE POPULATION
CENSUS OF CANADA FIGURES

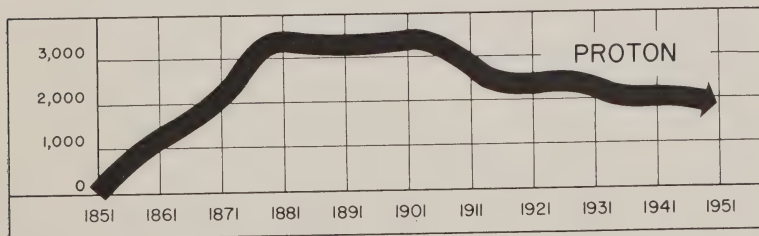
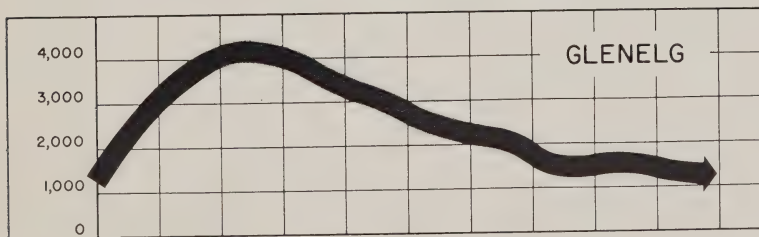
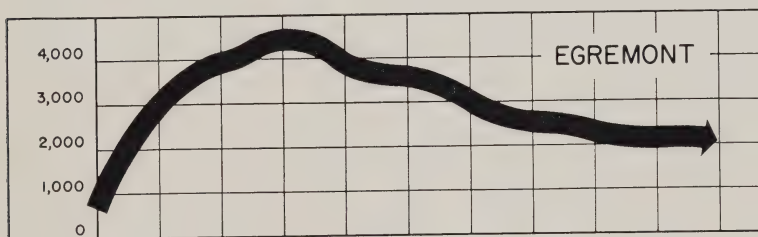
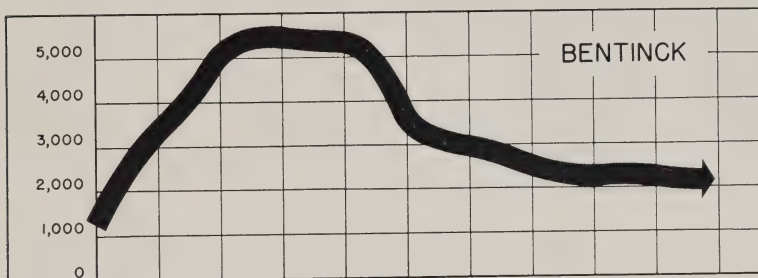
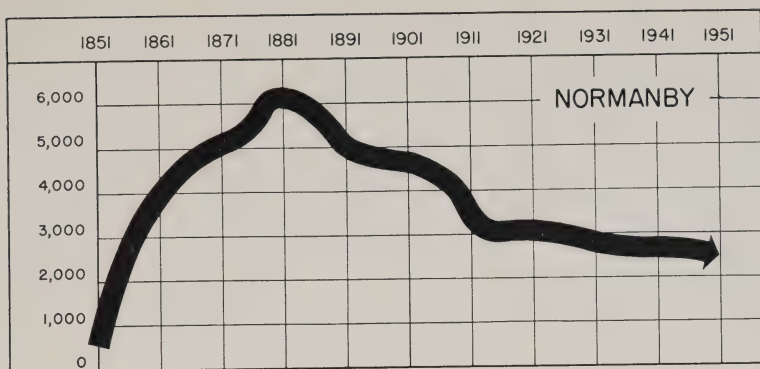


TOWN POPULATION
CENSUS OF CANADA FIGURES



TOWNSHIP POPULATION

CENSUS OF CANADA FIGURES



TOWNSHIP POPULATION

CENSUS OF CANADA FIGURES

was an exciting one. In the hands of inexperienced farmers or woodsmen, a scow could prove to be a cranky craft, and a raft of cedar logs a most ungovernable contraption. Some grounded in the many shallows and had to be lightened by throwing overboard a part of the treasured cargo; some were wrecked, and their crews had to be rescued from a river they had not yet learned to navigate; and a few were drowned. Lynn himself, having returned to Toronto during the winter of 1850-51, witnessed the wreck of a scow on his second trip down the Saugeen in April, 1851. There were now the following routes by which, singly or in combination, settlers were finding their way into the Saugeen country:

1. Via Penetanguishene and Georgian Bay.
2. Via Goderich and Lake Huron.
3. Via the Garafraxa Road.
4. Via the Toronto-Sydenham Road.
5. Via one of these two, and the Durham Road.
6. Via the Durham Road, and the Saugeen River.

After the opening of the county land offices, the lands in their respective areas were offered for sale to those who should apply for them to the Land Agents. But throughout the entire Saugeen Tract there were hundreds of settlers who had selected their sites before there was any provision for such sale, and even before the lands had been surveyed. "To make good their claim as squatters and retain their rights to the land settled upon it was necessary to have their names entered as purchasers, make a first payment, and obtain a license of occupation. . . ." In Bruce County, it was decided to hold a sale of all remaining Crown Lands in the county, and the date was set for September 27, 1854, at Southampton. This event came to be known as the "Big Sale". On the day named, more than two thousand would-be purchasers were present, the accommodation of the village was taxed beyond capacity, whiskey was more plentiful than bread, and rivalry and general excitement ran high.

In spite of the various delays, in spite of the speculators, in spite of the discouraging roughness of the roads (or their entire absence), and in spite of the hardships involved in the effort to convert the forest into homes and the wilderness into civilized communities, the process of settlement went on with astonishing rapidity. In 1851, the census returns indicated that the population of the entire Saugeen Watershed was 8,556. During the ensuing thirty years the population increased at an average rate of 2,600 persons per year, until by 1881 the same area contained 86,843 persons, occupying nearly 10,000 farms.

It is a simple matter to trace the course of the growth of population in the Saugeen in the early days of the development of that region. Settlers poured in by the thousands, and most of those who went into the area remained and made it their home. The course of growth reached its peak about 1881, and from that time forward the population began to decline. In the early years of the '70's, the Saugeen began to feel the effects of the opening of the prairie provinces, and the settlers who had hewed their farms out of the Queen's Bush hankered for a chance to try their hand at lands that required no clearing.

CHAPTER 3

MILLS

The importance of mills in the development of early settlement in Upper Canada is well known. One of the settler's earliest needs was for lumber with which to build himself a house and a shelter for his cow, his ox, and his pig; and as soon as the first harvests had been gathered came the need for grist mills. Whenever possible the mills were operated by water power, and it was an important part of the instructions to surveyors to note and report all potential "Mill-sites".

"Your field book is to be kept in the accompanying form, comprising . . . 'all brooks and rivers, with their width, depth and course, rapids and falls, giving the estimated difference of level in feet, and stating whether they afford mill-sites, &c. . . ."

There must have been a lively demand for sawn lumber at Buck's Crossing (Hanover) in the days when settlers were building scows to carry themselves and their effects down the river in search of land. Robert Lynn was not a settler but a surveyor, on his way to lay out the Town Plot of Southampton, but his experience must have been that of many who were actual settlers and who travelled the same road in 1850 and 1851.

"Saturday, 19 (April 1851)—Set men to work to cut timber for the sides & cross-braces for a Scow-boat 30 feet long & 6 feet wide and purchased Boards for the Bottom & ends from a Mr. Lundy which he had for flooring, at 12s per 100.

"Monday, 21—cutting out timber for the Scow-boat, they had borrowed a most wretched whip-saw, I ordered the log to be taken out of the Pit and bored with an Augur, And split it with large Wooden wedges, and self assisted to cut the cross end pieces &c. . . ."

Yet at Buck's Crossing it was not until three years later, in 1854, that the first sawmill was built. In the course of those three years a considerable number of scows were built; houses were erected, roofed and floored; and the timber for several bridges was prepared. One hopes that the sawyers had better tools to work with than Mr. Lynn's "most wretched whip-saw"!*

1. ON THE MAIN SAUGEEN

The earliest known mill on any part of the Saugeen stood at the mouth of a small creek that empties into the Saugeen River in Lot 28, Concession B, Arran Township, some four miles above Southampton. It had a short and unhappy career, of which the following are the essential particulars.

On the 3rd of April, 1844, Samuel P. Jarvis, Chief Superintendent of Indian Affairs, in a letter to the Governor's secretary, Captain Higginson, laid before the Government the proposal for a mill.

"The head chief of the Chippewa Indians residing at Saugeen has arrived at Kingston with the view to obtain permission to have certain buildings, etc. erected for the general use and benefit of the Tribe . . . There is an eligible

*Whip-saw—see Forestry Section, page 92, second paragraph from bottom.

mill site on the land belonging to the Tribe and a saw mill will be a great service to the Indians and will amply repay the cost of its erection . . .”

The mill was to cost £150. On May 20, 1844, Benjamin Miller of Goderich contracted

“to build in a good and substantial and workmanlike manner a Saw Mill at Saugeeng aforesaid the dimentions of the Mill to be eighteen feet by fifty feet properly enclosed—and also to make the necessary excavation for the dam—The dam to be of logs and timber filled in with brush and gravel all the necessary machinery for the said Mill to be supplied and put in by the said Benjamin Miller—and the Mill to be finished and delivered over in good working order.”

During the summer of 1844, the mill was built, and on November 18, Inspector Alex. Robertson reported his satisfaction with the manner in which the contract had been fulfilled.

“Having examined the Saw-Mill, I found it perfect in every particular, the castings are of the best description and all the gudgeons turned, the Mill being put in operation it worked well, cutting a board of thirteen feet by fourteen inches in four minutes, with sixteen inches of water less than its proper head.”

A month and a half later, the dam was washed out in a mid-winter freshet; and on April 7, 1845, the Indians appealed to the Superintendent to compel Mr. Miller to make the necessary repairs, alleging that they did not consider the work to have been done “substantially as it might have been”. Mr. Jarvis wrote to the contractor to know whether he intended to repair the damage.

In his reply, Mr. Miller charged the Indians with neglect. “They did not raise the waist (waste) gates, and let the water overflow the dam. The dam can be made safe as near as I can understand in 3 days by 3 men.” It does not appear that Miller ever made the repairs, or that the mill ever ran again.

Some time in the 1850's, Charles Sing (or Sang) is said to have built a sawmill at the same spot, and the little creek is now known as Sang's Creek.

It is worthy of note that, judging by the time required to saw a board “thirteen feet by fourteen inches”, as reported by Inspector Robertson, the Indian sawmill of 1844 was apparently equipped with a circular saw, which by that time had begun to replace the less efficient upright saw.

Among the earliest mills on the Saugeen were the Edge Mills at Durham, built in 1847 by John Edge of Dublin, Ireland. These consisted of a flour mill, a sawmill, and a woollen mill. They not only supplied local needs, but also provided a surplus, especially of flour, for trade to other parts of the Province. In 1887 Edge's Mills were burned; in the following year they were rebuilt by Robert McGowan, and they remain in McGowan hands in 1952. The woollen mill was in the same building as the grist mill.

The “Durham Mills”, located on the west side of the Garafraxa Road in Durham, included a sawmill (1853) and a flouring and oatmeal mill (1859). By 1865, a woollen factory had also been added, where custom carding and fulling were done.

At Hanover, the earliest mill was a sawmill, built in 1854 by H. P. Adams, who in 1855 also built a grist mill. The “Directory of the County of Bruce”,



McGowan's grist mill, on the site of the former Edge's Mill, first built in 1847.

*McGowan's dam, formerly Edge's dam, on the main Saugeen River, at the east side of the Town of Durham.
The first dam on this site was built in 1847.*



1867, lists in Hanover a grist and flouring mill, a sawmill, and a carding and fulling mill. The sawmill disappeared from the records at an early date; the grist mill, familiarly known as the Old Red Mill, persisted through several changes of ownership until 1919, when it was destroyed by fire.

It was in 1850, the year that the Durham Road was chopped and the Saugeen spanned by a bridge, that Joseph Walker, the founder of Walkerton, took up the farm lots which were surveyed into town lots to provide the beginnings of that town. Two years later Walker erected a dam across the Saugeen River, and used the power thus obtained to operate a sawmill. In 1853 he added a grist mill. In 1871 the sawmill became the saw and planing mill of S. and T. H. Noxon and Co., and later was leased to R. Truax and Company. The grist mill was burned in 1864 and rebuilt in 1870; some time later it was again burned, and in 1886 again rebuilt by R. B. Clement as a roller-process flour mill.

There was in Walkerton another roller grist mill, on the west side of Silver Creek, operated by George Harrington, later sold to John Lee. For a time there was also a woollen mill, which in 1902 removed to Cargill. The "History of the County of Bruce" mentions also a flax mill and an oatmeal mill operated by George Shortt, of which in 1906 only ruins remained.

2. ON THE ROCKY SAUGEEN

The village of Markdale had its beginnings in 1849, when George Walker took up a lot on the Toronto-Sydenham Road and built his shanty near the four corners that became the centre of the settlement. It was not until 1855 that the newly settled village had a mill. In that year,

"Matthew Irving built the Barrhead flour and saw mill. This four-storey building required all the men available for miles around for five days to raise the framework. It was a remarkable building for its day. It was a great boon to the community."

Other mills built near Markdale in the course of the next few years were Ford's flour mill and Sims' woollen mill.

Six miles below Markdale, on the Rocky Saugeen, is the village of Traverston, once known as Waverley. Here, about 1856, the partnership of Schofield & Collier planned an ambitious community, of which the main enterprise was to be their "mills". Their plan of the "town", published by Maclear & Co., Toronto, shows the locations of a sawmill, a flour mill, a cabinet and chair factory, and a general machine shop, in addition to various town lots represented as being sold to thirty-eight actual or prospective settlers, most of whom were holders of farm lots in Glenelg and other nearby townships. It seems probable that at first only the sawmill was built, since that is the only mill listed nine years later in the directory; by 1865 the sawmill had been sold to John Travers, whose name the village still bears. Modern maps of Traverston show both a sawmill and a grist mill, but their history between 1865 and the present time remains for the most part obscure.

At Hayward's Falls, Herbert Rowswell built a sawmill in 1857. At his death it passed in 1865 to Mary Rowswell who sold it in 1873 to Hayward.



The present Barhead Mill, a grist mill on the site of the former Barhead Mills, was first built in 1855.

A picnic party, in 1906, on the remains of Dunsmoor's dam. On this site, Alexander McNabb built the first dam on the Rocky Saugeen, in 1846, about four miles north of Durham. (From an old photograph, dated 1906.)



After that, the mill changed hands several times, the successive owners being Robert Jaques (1878), William Falkingham (1889), Minnis Brothers (1904), and W. L. Young.

In a biographical note sketching his career as a surveyor, Milton C. Schofield, Provincial Land Surveyor, wrote in 1908:

"In 1848 I opened a country store on the Rocky Saugeen, in Bentinck, four miles north of the present town of Durham. In 1849 I was appointed postmaster. In 1850 I built a mill on the 'Rocky'."

The "mill" in question consisted of a sawmill and a flour mill at Glenrodin on the Rocky Saugeen, about a mile and a half east of the Garafraxa Road. Within a few years Schofield had sold these mills to Samuel B. Chaffey, who added an oatmeal mill and a carding and fulling mill to the enterprise; while Schofield's interest appears to have been taken up with his partnership in the Waverley (Traverston) project.

Apart from the Indian sawmill at the Chippewa village near Southampton, the earliest mill on the Saugeen was McNab's sawmill on the Rocky Saugeen, which the surveyor Rankin reported in his examination of mill sites on the Garafraxa Road. Rankin's plan accompanying his report makes it clear that this site is on the Rocky Saugeen at the point where the Garafraxa Road crosses it, and that McNab's mill stood about a quarter of a mile up stream from that point, on the spot that in 1848 was the site of John Dunsmoor's saw- and flour mill. Dunsmoor's dam was washed out about 1906; and in 1911 the Durham Furniture Company rebuilt the dam and set up an electric power plant on the site of the old mills, which still (1952) supplies a large part of the Company's power requirements.

A short distance down stream from the Garafraxa Road, and on the Rocky Saugeen, Ferguson's Flour Mills were built in 1857, "a substantial stone building with 4 run of stone, and abundant water-power". It is said that Ferguson's right to the mill "privilege" was never wholly secure, and that he used great care not to raise the water above his dam to such a level as would back it against Dunsmoor's mill. In the directory of 1865, this mill is listed as the property of John McIlroy. It has for many years been disused.

In 1865 the directory states that Caton's sawmill was in operation at Aberdeen and that Francis Caton occupied Lot 41 in the 2nd Concession West of the Garafraxa Road. This lot had been originally patented in 1852 to Herman Schofield. In 1870 it was sold to one Kay, and by him in 1879 to James Crawford; and the mill came to be known as Crawford's Mills. Since 1934 the mill has not been in operation.

Some time prior to 1865, Robert Dalglish is said to have built a sawmill at the junction of the Rocky Saugeen with the main river, some four miles west of Durham. Dalglish called it the "Junction Mill", but among the country people of the neighbourhood it went by the name of "The Crotches". Lovell's Directory of Canada, 1871, lists Robert Dalglish as a mill-owner, but indicates that he was residing in Durham.

*Ferguson's grist mill, on
the Rocky Saugeen River,
one-quarter mile west of the
Garafraxa Road. Built
in 1857.*



*Grist and sawmill at
Traverston (formerly
Waverley). At or near
this site, Messrs. Schofield
& Collier first built a saw-
mill in 1856.*



3. ON THE SOUTH BRANCH OF THE SAUGEEN

When the first dam was built at Mount Forest, in 1850, it was supposed that the river at that place was a tributary of the Maitland, and the enterprise was called the Maitland Mills. To the original flour mill, a sawmill was added in 1856. The mills were located about half a mile down stream from the Garafraxa Road. A few years later, with John Martin as proprietor, the mills were known as Martins Mills; and in the Directory of the County of Wellington, 1869, three flouring mills were listed in Mount Forest: Martin and Sons, flour and oatmeal mills; Yeomans' mills; and Henderson's mills.

David Yeomans was the proprietor of a sawmill and grist mill close by the bridge where the Garafraxa Road crossed the South Branch; and, according to the Directory of Grey County, in 1865, William Henderson was the lessee of the grist mill. Between Yeomans' mill and that of the Martins there was, in 1865, a woollen mill, which "has one complete set of manufacturing machines, and also does custom carding, weaving, fulling, etc. It was built about 6 years ago (1859)". In the Directory of 1869, the woollen mill is listed as "Enterprise Woollen Mills, Tanner and Harris".

The Directory of Grey, 1865, described the mill-site at Ayton as excellent: "Water is abundant; the channel is narrow; the wooden dam is fastened to solid rock". Three mills were located here. The first sawmill was erected in 1861, followed by a grist mill in 1864 and a carding mill in 1865.

The purchase by David Winkler, in 1855, of 400 acres of land on the South Saugeen, six miles south of Hanover, marks the beginning of the village of Neustadt.

"A little stream runs through the village, being a tributary of the south branch of the Saugeen, which at this point is called the Meux Creek. The Saugeen flows in a north-westerly direction about half a mile east of the village, where, at one time (about 1856), it looked as though the village would be situated. A grist mill, a woollen mill, an hotel, a flax mill and a general store were started there, and the site was called 'Viel-Noethig'—('much-needed'). However, owing to the better water and power facilities on the little branch, Mr. David Winkler erected a saw mill, and (in 1857) a flour mill and grist mill there."

According to the Directory of 1865, Mr. Winkler built his sawmill on Meux Creek in 1855, and his flouring mill, with two run of stones, supplied with water from the same dam, in 1857. The Directory also states that Winkler erected in 1864 a four-storey building on the South Branch (at "Viel-Noethig"), "intended for 4 run of stones", but does not indicate whether this mill was ever put into operation. In the same year (1864) the Neustadt Flax Mills, located at "Viel-Noethig" and using power from the South Branch, began operation, Messrs. Perine and Hendry being the proprietors. The flax at this mill was not manufactured into linen, but was merely scutched, and the product was sent to Doon in Waterloo County to be spun, woven, and bleached. At the present time (1952) nothing remains of the mills on the South Branch, though the grist mill on Meux Creek, partly burned, and re-built, is still in use. In the original stone foundation, the corner-stone, marked "D. W. 1857", is still to be seen. There is also a sawmill on the Meux Creek, not deriving power from the grist-mill dam, but from a dam a short distance farther up stream; the records of the village clerk indicate that this sawmill was built in 1870.

4. ON THE BEATTY SAUGEEN

This is a relatively short branch of the Saugeen, and there are no large milling centres on it. Among the earliest mills there were two where the stream crosses the Garafraxa Road. John Orchard's sawmill (1858) and James Dodds' flour mill (1859) were located near the little village of Orchard. The mills of John Shields at Holstein were important factors in making that village a leading place of business in the Township of Egremont.

5. ON THE NORTH BRANCH OF THE SAUGEEN

The first sawmill in the Township of Holland was located at Holland Centre and was built at a date prior to 1853. On the same site has since been built a grist mill.

Williamsford, located on the Garafraxa Road at the point where it crosses the North Branch of the Saugeen, has since 1855 been an important milling centre. In that year a sawmill was built; the Directory of Grey, 1865, names A. E. Strathy as the proprietor.

In 1880 A. S. Elliot built the Monarch Mills at Williamsford. For several years there was also a woollen mill in operation at Williamsford; this was destroyed by fire in 1881.

At Scone, one mile east of Chesley, Thomas Bearman, about 1856, built a sawmill, to which he later added a grist mill and a potash factory.

The earliest mills at Chesley were built by A. S. Elliot and were known as the Elliot Mills. These consisted of a sawmill, built in 1858, and a grist mill, in 1859. In 1875, Messrs J. H. Elliot and Alex. Ramage rebuilt the grist mill, which was then described as "the most complete of its kind".

Between Chesley and the point at which the North Branch empties into the Main Saugeen, there are two mill sites. A surveyor's report compiled in 1853 describes a sawmill and oatmeal mill on Lot 23, Concession III, Elderslie Township, Archibald McDonald, proprietor; on the same site in 1952 is a sawmill, shown in the accompanying illustration. At Lockerby, about one mile from Paisley, a grist mill was built about 1856.

6. ON THE TEESWATER RIVER

This important branch of the Saugeen River provides power for mills at no less than five points, namely Teeswater, Chepstow, Cargill, Pinkerton, and Paisley.

The original mill builder and operator at Teeswater was P. B. Brown, who built a sawmill in 1855 and a grist mill in 1856. In the Directory of the County of Bruce, 1867, Mr. Brown advertises: "Lumber of all kinds always on hand & cut to order. Gristing promptly done. Mill privilege and village lots for sale."

At Chepstow, John Phelan built the original dam and sawmill. Later, a grist mill was built on the same site. Three-quarters of a mile west of Chepstow, a sawmill was also built.

In 1856 the brothers McNeil built a dam and grist mill, at Cargill, which they later sold to George Elphick. In 1871, Elphick sold the mill privilege to Charles Mickle, Sr., who added a sawmill. The entire property was again sold in 1879, to Henry Cargill. Cargill later added a steam sawmill, a steam planing mill, and a steam grist mill.

Beginning about 1853, John Shennan built at Pinkerton a sawmill and a grist mill, which in 1854 he sold to David Pinkerton. Later a carding and fulling mill was added. The 1867 Directory also lists a shingle mill.

As early as 1851, John Valentine took possession of a mill site on the Teeswater River at Paisley, and in the following year built a sawmill. In 1855, Valentine built a grist mill. A survey by the land-surveyor Kerr, in 1856, shows Paisley to have in operation, at that time, three sawmills and one grist mill. By 1867 there was also a carding and woollen mill in operation at Paisley, but it is not stated whether it was on the Teeswater, or whether it made use of any water power. A mill privilege that was sold in 1859 by S. T. Rowe to David Hanna, and called the Fisher Mill, appears to have been located on the Main Saugeen River and not on the Teeswater. The History of Bruce County merely states that at this point milling was carried on.

7. ON OTTER CREEK

The principal centre of milling operations on the Otter Creek is at Mildmay. Here, in 1856, Samuel Carr built a sawmill, operated by water power. In the basement of the same building, and in the same year, Lambert's carding mill was accommodated. In 1864 Wm. Murray changed the sawmill to a grist mill; not long afterward this mill was destroyed by fire, and in 1867 it was rebuilt. Later, the mill was again destroyed and the dam washed out. There is now no mill at this point.

About 1860, Messrs. Eidt & Noecker built the Mildmay Chopping Mill at the south end of the town, which later became the Mildmay Co-operative. This also, at the present time (1952), is no longer in use as a mill.

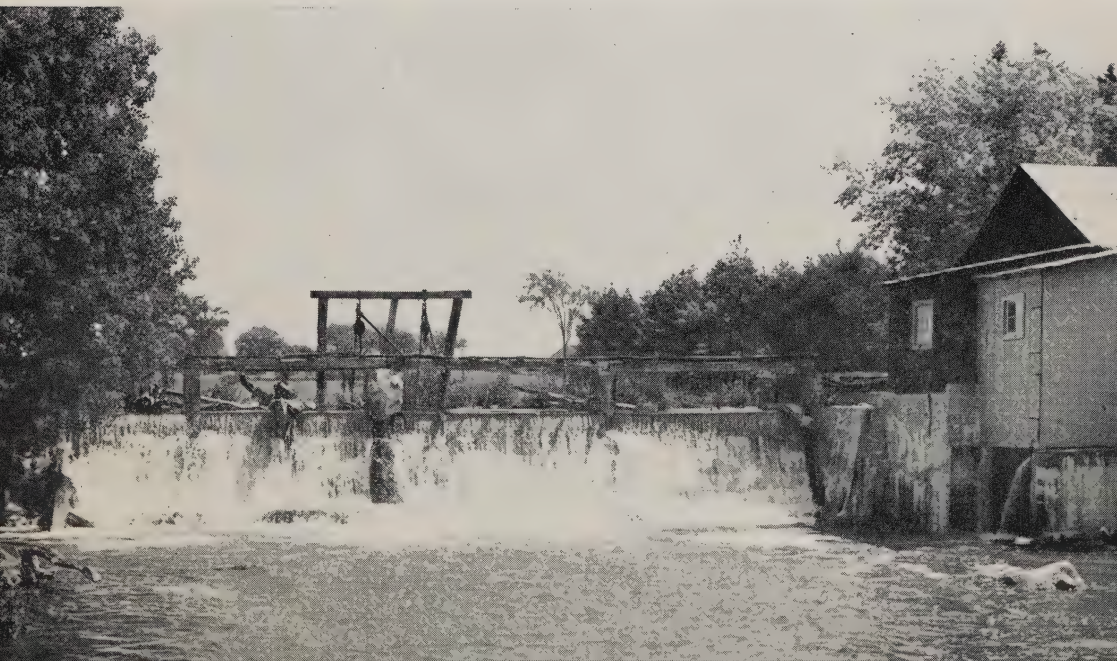
Berry's woollen mill was built on Otter Creek in 1866. McKelvie's woollen mill, built at the north end of the town, later became a furniture factory. Other "mills" at Mildmay include Bitschey's pottery works and Archie White's wagon factory.

At a point on the Otter Creek half-way between Mildmay and Walkerton, George Harrington in 1862 built a grist mill which operated for about twenty-five years and then was burned. In the '70's another mill was built near the same spot by Messrs. Wm. Clendenning and W. Brown. This latter mill, upon its owners' financial failure, passed into the hands of the Merchants' Bank. In 1886 it was sold to Steinmiller, who operated it as the "Saugeen Valley Roller Mill". At the present time (1952) it is operated as an electric power plant, supplying power to the town of Walkerton.



Grist mill and dam, at Scone, built in 1856.

Sawmill and dam, one-and-a-half miles west of Chesley, on the North Branch of the Saugeen River. First mill on this site was built in 1853, by Archibald McDonald, and included an oatmeal mill.





The Hewgill steam sawmill at Priceville

MILLS NOT LOCATED ON WATER POWER

Location	Proprietor	Type of Mill	Dates
4 miles E. of Priceville.....	not known	saw	-1945-
Hopeville.....	not known	saw	"early"
Fulton's Station.....	not known	saw	-1937-
Clifford.....	Veitch Bros.	saw	-1869-
Clifford.....	J. Boomer	grist	-1869-
Clifford.....	A. Kerr	planing	-1869-
Clifford.....	F. F. Dobson	shingle	-1869-
Clare, in Egremont Township....	Thorpe	saw	not known
Lauriston, in Glenelg Township...	not known	saw	-1945-
3 miles S.W. of Dornoch.....	not known	saw	-1945-
West Bentinck.....	James Wilson	saw	1857-
Mulock (or Corinth).....	Douglass	saw	not known
Berkeley.....	not known	saw	-1945-
Eden Grove.....	Munn and Webster	saw and shingle	1873-
Elmwood.....	Johnson Smith	saw	1875-
Elmwood.....	John Dirstein	saw	1875-
Elmwood.....	not known	grist	1864-
Hanover.....	H. P. Adams and Jacob Messinger	woollen	1870-
Kinlough.....	Simon Corrigan	saw	1857-
Kinloss.....	J. Eli Stauffer	saw	1854-
7 miles W. of Paisley.....	not known	grist	-1946-
Glammis.....	John Fraser sold to McIntyre, then to Pickard	saw	"early"

CHAPTER 4

AGRICULTURE

The beginnings of settlement in the Saugeen found the uplands covered with a hardwood forest and the low-lying lands covered with swamps where cedars, tamarack and ash were the characteristic growth. Along the river flats there were extensive areas of native grasses; and these were regarded as the basis of the earliest agriculture, a crop ready to hand, provision for the ox, the horse, and the cow, for which neither clearing nor seeding was required. The following passages, taken from the earliest survey reports of three townships in the Saugeen Watershed, will indicate the value that was set on these natural meadows:

Sullivan Township

"It affords every inducement to Settlers, presenting generally the agreeable features of an undulating surface, good soil (principally clay), and an excellent quality of timber, to which advantages may be added that of its containing a great number of beautiful meadows on which usually prevails what is always a desideratum in going upon new lands, excellent grass."

Osprey Township

"There are several natural or Beaver Meadows in this Township, some of which afford a very good description of grass and will be found very useful by those who will settle near them being so found by the squatters already there."

Minto Township

"Most of the little Streams, whether running into the Saugin or into the Maitland, are bordered in places with meadows, which will naturally prove an advantage to the first Settlers, as affording fodder for their cattle before tame meadows can be made."

The first census report of agricultural production in the Saugeen country that of 1851, indicates that wheat and oats were the chief grains, potatoes and turnips the chief non-cereal crops; some two thousand tons of hay, mostly from natural meadows, was cut; and considerable quantities of butter, cheese and wool were produced. Thirty-five thousand pounds of maple sugar were harvested.

In spite of the success attributed to the Petuns, the white settlers in the Saugeen have never made much of either tobacco or Indian corn; both these crops appear to have been tried in the earliest pioneer days and subsequently discarded. The census of 1851 reports, over the entire Saugeen Watershed, no more than 120 pounds of tobacco; in later reports, none was shown. Indian corn, in 1851, amounted to 1.1 per cent of the reported grain yield, and thereafter it never amounted to more than 0.3 per cent of the total grain, this maximum having been shown in 1891. In the latest census in which yields of grain are reported, that of 1921, Indian corn amounted to less than one-one hundredth of one per cent of the total grain in the watershed.

In 1861, when fall and spring wheat were first reported separately, the spring wheat greatly exceeded the fall wheat. During the decade 1871-1881, the fall wheat took the lead and has held it ever since. These comparisons are shown in the following table:

Year of Census	Spring Wheat (Bushels)	Fall Wheat (Bushels)	Total
(1851 .....	.....)	.....)	65,190
1861	807,591	27,989	835,580
1871	702,354	99,282	801,636
1881	451,798	1,288,606	1,740,404
1891	209,873	663,724	873,597
1901	161,366	734,069	895,435
1911	52,509	778,501	831,010
1921	45,291	527,739	573,030

The yields of oats, barley and peas-and-beans (which, from 1871 on, are reported together) are shown here for comparison with the yields of wheat.

Year of Census	Oats (Bushels)	Barley (Bushels)	Peas & Beans (Bushels)
1851	54,970	3,443	9,154*
1861	393,329	32,653	129,754*
1871	1,186,448	244,397	477,321
1881	1,923,532	282,027	865,755
1891	3,097,325	282,322	1,112,173
1901	532,220	657,248	1,077,918
1911	5,727,577	796,292	448,849
1921	5,859,989	542,083	130,505

*Peas only.

The yields of potatoes, roots and hay are shown in the following table:

Year of Census	Potatoes (Bushels)	Turnips and Other Roots (Bushels)	Hay (Tons)
1851	96,015	55,196	2,322
1861	570,110	1,307,959	19,217
1871	747,746	1,391,256	71,909
1881	772,552	2,399,152	103,014
1891	901,382	3,063,271	183,258
1901	759,368	4,324,253	136,038
1911	690,352	2,722,468	212,766
1921	621,098	2,258,573	185,027

The census reports show the numbers of farm animals by townships (from which the corresponding numbers for the watershed may be calculated) only in the years 1851, 1861, 1891, 1931 and 1941; and the data for 1901 provide an approximate basis for a similar calculation. The census enumerations for 1871, 1881 and 1911 were based on the electoral district, and those of 1921 on the county, as a unit of area; and it is not possible even to estimate from such data the proportionate numbers in the watershed. The following tables show, as nearly as they can be calculated, the numbers of farm animals in the Saugeen Watershed and the production of butter, cheese and wool:

Year of Census	Cattle	Horses	Sheep	Swine
1851	7,542	320	3,132	3,571
1861	38,973	4,604	18,751	25,436
1871				
1881				
1891	106,993	33,884	76,377	44,429
1901	128,683	29,736	82,049	67,949
1911				
1921				
1931	128,394	27,812	73,413	77,201
1941	142,654	26,037	52,115	97,673

Year of Census	Butter (Lbs.)	Cheese (Lbs.)	Wool (Lbs.)
1851	85,660	3,970	7,829
1861	623,624	29,035	38,093
1871			
1881			
1891	2,674,006	61,932	344,984
1901	3,966,069	1,631,206	401,540
1911			
1921			
1931	2,251,875	1,150*	566,667

*Amount produced on farms only.

The data appear to warrant the following comments:

Spring wheat reached its peak in 1861, and has since been continuously declining.

Fall wheat reached its peak in 1881, and has since held fairly steadily to approximately half the amount of that peak. In 1921 it exceeded spring wheat about 13 to 1.

Oats increasing continuously up to 1921, when census report of quantities produced ceased.

Barley reached its peak in 1911 and fell off 32 per cent by 1921, when last reported.

Peas and beans reached a peak in 1891, and after 1901 declined rapidly.

Potatoes reached a peak in 1891, and by 1921 had declined 31 per cent.

Turnips and other roots reached a peak in 1901, and by 1921 had declined 48 per cent.

Hay reached a peak in 1911, then fell off 13 per cent.

Cattle, so far as data are reported, show a continuous increase from 1851 to 1941. The census does not distinguish between dairy cattle and beef cattle.

Horses reached a peak number in 1891 and have since then been gradually declining, largely, no doubt, because of their replacement by mechanical equipment.

Sheep reached a peak in 1901, the number reported in 1941 being 35 per cent of that peak.

Swine—the numbers show a continuous increase up to 1941.

Butter—the figures given indicate a peak in 1901; but the lack of reliable data in 1911 and 1921, together with the trend toward creamery production (not included in the census returns) makes the record too uncertain for satisfactory analysis.

Wool—the data indicate a continuous increase up to 1931, which is not, in the period from 1901 to 1931, parallel with the data on the numbers of sheep. The lack of any data in the intervening decades makes reliable analysis impossible.

In general, the record of the census shows a region engaged in mixed farming, in which the food-producing animals have been continuously increasing; while those crops that supply feed for the animals have tended to predominate over the crops that yield food for immediate human consumption. This trend in the crops has become more pronounced since 1891, when wheat, peas and beans, and potatoes had reached and passed their production peaks.

2

LAND

CHAPTER 1

GEOLOGY

The bedrock formations of the Saugeen Watershed belong to the Paleozoic era in the Silurian Period. The most characteristic topographic feature of the Silurian system in Ontario is the Niagara escarpment which separates the Western Ontario Uplands from the St. Lawrence Lowlands to the east. The escarpment is an erosional feature and, since it is capped by a resistant formation, it is able to retreat while keeping an almost perpendicular face.

From the escarpment face, the Silurian rocks dip gently westward, giving progressively lower elevations. This change in elevation is accentuated by a broad up-arching of the bedrock caused by large-scaled earth movements. This structure is called the Ontario Upland. Thus the highest point is not on the



brow of the escarpment, as might be expected, but around Dundalk, which is near the top of the arch. This progressive lowering of altitude westward is the main factor in determining the course of the Saugeen River. The Saugeen and its tributaries are flowing down the dip-slope of the escarpment. The Rocky Saugeen has cut through the overlying deposits and is incising its channel into bedrock for much of its length. The main branch, however, only encounters bedrock at one place, Glenelg Centre.

Three different formations comprise the Saugeen bedrock—the Lockport, Guelph and Salina formations. All three are composed largely of dolomitic limestone, that is, limestone which contains a high proportion of magnesium carbonate as well as calcium carbonate, the chief constituent of ordinary limestone. The Lockport Dolomite is light gray in colour and is quite hard and massive. When exposed to weathering it tends to split off in large blocks. The Lockport formation forms the resistant cap of the Niagara escarpment. The Guelph formation differs slightly in colour and chemical composition. Both have been quarried extensively for building stone. The Salina formation is composed largely of brown-coloured dense dolomite. It is not as hard as the first two and weathers more rapidly. The formation also contains some shale and, in some parts of the Province, salt and gypsum.

The limestone bedrock was eroded, ground up and redeposited by the action of continental glaciers. Because of the high lime content of the soils, leaching by water has been inhibited, giving rather shallow profiles throughout the area. The high lime content of the soils, together with their loamy and gravelly nature, makes the streams run clear, even after heavy summer rainfall.

In some places, the limestone bedrock has tended to limit agriculture. Sometimes, the glaciers quarried out the limestone in large pieces and later re-deposited them as boulders. Often the boulders are numerous enough to prevent cultivation entirely.

Limestone bedrock is very porous and allows water to seep through it readily. Therefore, areas where the bedrock is close to the surface tend to be somewhat droughty. Sometimes underground channels are formed by solution and a system of underground drainage is established. Such underground drainage forms the spectacular waterspouts west of Traverston.

The recent geologic deposits overlie the bedrock as an unconsolidated mantle. These deposits are the result of continental glaciers which moved over the area from the north. These deposits and the landforms associated with them will be described fully in the next chapter.

CHAPTER 2

PHYSIOGRAPHY

1. INTRODUCTION

This chapter deals with the surface relief as it appears today, that is, the landforms and the materials from which they have been formed, which are the result of glaciation. While the different types of landforms are usually referred

Limestone outcrop along the Rocky Saugeen, near Aberdeen. Limestone is a major constituent of the soils of the watershed.



The Main Branch of the Saugeen south of Priceville. The direction of flow of this stream is controlled by the dip of the bedrock.

The waterspouts on the Rocky Saugeen below Traverston. Water flows underground in solution channels in the bedrock.



to in terms in use in glacial geology, throughout this report local names will be used as far as possible.

2. GLACIATION

During the recent geologic past, in the age called the Pleistocene, Canada was covered by a great continental ice sheet. The masses of ice forming the ice sheet reached thousands of feet in thickness. While it is believed that the ice advanced and covered Ontario three times, it was the last glaciation which moulded the surface of the land into the forms which we see today.

The landforms arising from glaciation fall into two main groups. The first group was formed during a period of ice advance. The second group was formed during a period of stagnation, when the ice front was retreating and the ice sheet itself was becoming thinner due to melting.

In the "advance" phase, rock material was broken up, pulverized, moved and redeposited. This redeposited material is known collectively as "till" and the resulting landform is called a "till plain". Till varies in texture from "light" to "heavy" depending on the amount of clay it contains. All till contains a great number of stones, mostly angular in shape.

Sometimes the glacier moulded the till into long oval-shaped hills which are often called whalebacks or "drumlins". Drumlins characteristically have one steep end, called the "stoss" end, and a long tapering tail pointing in the direction of ice movement. The soils of the drumlins are loamy and well drained, but the areas in between them are usually swampy. They vary greatly in size and height, ranging from quite large hills to low ridges.

Whenever the glacier halted for a sufficient length of time, a ridge of till was built up in front of it. This is called an end moraine. Moraines are characterized by a great many knobs and depressions and sharp, abrupt slopes. They always contain much rough land and are sometimes excessively stony.

During periods of stagnation, deposits were formed underneath the melting ice front. These are the "ice-contact" formations and the materials in the formations are sorted and roughly stratified by the action of water. Delta-like fans were built against the ice face by meltwaters and when the ice finally disappeared these materials slumped down to form conical hills called kames. A succession of this type of landforms is called a kame moraine. Kames are a valuable source of gravel. Often rivers flowed within the ice sheet itself. These rivers deposited gravel in their beds and when the ice melted, the gravel slumped down to form a long sinuous ridge, which in some cases may be traced for several miles. These are called eskers, and are also extensively used for gravel.

Meltwaters flowing away from the ice sheet carved deep valleys, called spillways, through the moraines and the till plains. These valleys are characteristically wide and flat-floored, and have extensive gravel deposits along the sides. The bottoms are usually swampy. Sometimes the present-day rivers make use of these channels, although others are dry.

The final type of glacial landform is material which was left when the ice simply disintegrated. This is known as ablation moraine, and forms a super-



A drumlin. This landscape is characteristic of the Bentinck Whaleback Hills. Glenelg Township.

The Glenelg Gravelly Hills. Note the sharp slopes and irregular topography.



The Holland Ridge, south of Berkley.



ficial covering in many parts of the watershed. It is very coarse, stony material from which most of the fine particles have been removed, leaving only the coarser silts, sands and gravels. They have not been sorted by water and exhibit no stratification.

3. LANDSCAPE TYPES

On the basis of landforms the Saugeen Watershed can be divided into a number of "landscape types".

(a) THE HOLLAND RIDGE

The Holland Ridge forms the northern boundary of the watershed and extends through Osprey and Artemesia Townships to form the eastern boundary. It is a typical end moraine described in the previous section. The topography is rough and broken with many steep slopes and swampy depressions. The materials grade from medium-textured till in the western section to light, stony till in the east. The Holland Ridge also contains large limestone boulders which have been plucked off the face of the Niagara escarpment by glacial action.

(b) THE HANOVER SANDY PLAIN

The Hanover Sandy Plain occupies part of the western section of the watershed around the town of Hanover. The plain has an undulating surface and rises in a series of terraces of stratified material on each side of the Saugeen River. The terraces were deposited by a post-glacial river which carved out the present Saugeen Valley. The soils in this area are sandy, although the upper terraces contain a large proportion of gravel.

(c) THE BENTINCK WHALEBACK HILLS

This type occurs in most of the northern and eastern part of Bentinck Township and part of Glenelg Township. They have long, convex slopes and are easily recognizable in that the steep ends are usually forested. Swamps are common on the inter-drumlin areas. The region is complicated by the presence of ice-contact features among the drumlins. There are a number of small eskers following the low areas and the occasional kame is also found. In addition, the hills have received a superficial covering of ablation moraine which gives the surface a stony appearance. The material which forms the hills is loamy in texture, giving rise to good agricultural soils.

(d) THE DURHAM ROLLING PLAIN

The Durham Rolling Plain is found to the west of the town of Durham and again in the Edge Hill area. It is a till plain and is formed of similar material to the Whaleback Hills, and the soils are therefore loamy. The plain is not flat, but rolling in nature.

(e) THE GLENELG GRAVELLY HILLS

The Glenelg Gravelly Hills occupy nearly all of the southern and eastern part of Glenelg Township. This is a rugged hilly type, with very little level land, and many of the slopes are extremely steep. The gravelly hills are for the most part ice-contact deposits—kames, kame moraines and gravel terraces.

The deposits are roughly stratified, although some of the materials are so coarse that the stratification and sorting is not always evident. Because of the coarse, open texture of the materials, the soils are extremely thin and porous, so that summer drought is a constant hazard. The steep slopes and gravelly nature of the soils limit the use of modern agricultural machinery. For these reasons large parts of the Glenelg Gravelly Hills are either forested or are left for pasture.

A group of hills similar in nature to the Glenelg Gravelly Hills is found near Allan Park. Part of these hills can be seen along No. 4 Highway just east of Allan Park. Here the material is very stony. South of Allan Park the hills are broken by a large glacial spillway, but they reappear on the south side of the spillway. Here the materials forming the hills are partly stratified sand, in contrast to the gravels to the north. Like the Glenelg Gravelly Hills, forest and pasture are the predominant uses of the area.

(f) THE MARKDALE ROLLING PLAIN

This type is clearly defined as a region. It lies south and east of the village of Markdale, between the Glenelg Gravelly Hills and the Holland Ridge. The area is a rolling plain, with materials coarser than those of the Durham Plain, giving rise to quite stony soils. The headwaters of the Rocky Saugeen flow through this region.

(g) THE DUNDALK SILTY PLAIN

This landform type occupies nearly all the eastern part of the watershed, in Osprey, Proton and Melancthon Townships. It is a very distinctive region and is part of an extensive till plain which covers much of the central Ontario Uplands. The northern margins of the region are marked by a few low drumlins, which become low ridges toward the south. Throughout the Dundalk Plain, drainage conditions are poor, especially between the ridges. The low ridges are important agriculturally, since they dry up earlier in the spring. No. 10 Highway follows a zig-zag course to take advantage of the drier ridges. The road crosses the swampy areas at the narrowest points, thus avoiding long stretches of expensive fill.

The Dundalk Till Plain is very different from the other two till plains of the Saugeen. Besides being poorly drained, it has received a superficial deposit of silt on the surface, variable in depth from a few inches to over two feet. It is usually deeper in the hollows than on the ridges.

The Dundalk Plain also has some scattered ice-contact deposits. There are a number of kames near Proton Station and there is a large kame to be seen on No. 10 Highway north of the Proton side-road. It has been partly demolished to provide gravel. There is a large esker in the Osprey Swamp, which forms the eastern boundary of the watershed. There are also some small eskers and kames scattered through the Proton Swamp.

The main branch of the Saugeen River rises in the Dundalk Plain. In this region it follows a meandering course over the plain in a very shallow valley. Because of this, it is susceptible to flooding during the spring. Ice tends to pile up in the river and the shallow valley is unable to contain the water from melting snow.

*The Dundalk Silty Plain in
Proton Township.*



*The Durham Rolling Plain.
Glenelg Township.*



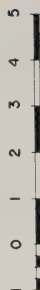
*The Bell Lake Spillway. This
is characteristic of the Saugeen
Swampy Flats. The poorly
drained section in the bottom
of the spillway usually remains
in cedar swamp.*



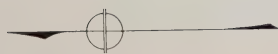
LANDSCAPE TYPES



- HOLLAND RIDGE
- HANOVER SANDY PLAIN
- BENTINCK WHALE BACK HILLS
- DURHAM ROLLING PLAIN
- GLENELG GRAVELLY HILLS
- MARKDALE ROLLING PLAIN
- DUNDALK SILTY PLAIN
- SWAMPY SAUGEEN FLATS



SCALE - MILES



(h) THE SAUGEEN SWAMPY FLATS

The Flats do not form a continuous region, but are found scattered throughout the whole watershed. They are the bottoms of the valleys cut by the rivers carrying away the meltwaters from the retreating glacier. Sometimes they are occupied by streams, but often no permanent streams are found. Sometimes the valleys are not connected and seem to end abruptly. This has been due to blocking by later deposits.

The Saugeen Flats are almost always swampy, although the materials are largely gravels, sands and silts. Often they contain depressions which have formed small lakes. These lakes are kept in existence by the high water table and by springs and run-off from the valley sides. Bell Lake, Farden Lake and Wilder Lake are examples of this type. The lakes are gradually becoming filled up with aquatic vegetation. Wilder Lake was once an important source of marl, a deposit of almost pure calcium carbonate. Water flowing over the lime-rich soil materials absorbs lime in solution. It is then precipitated in the quiet waters of the lake.

The Saugeen Flats are of little use agriculturally, although some are dry enough for pasture. Usually the valley bottoms support only coniferous trees. In some places, notably at Allan Park, the flats are a valuable source of gravel.

4. THE DRAINAGE PATTERN

The control exercised by the general westward slope of the Ontario Uplands has already been mentioned. However, the overall drainage picture is one of immaturity in the smaller tributaries. These streams either meander sluggishly through the old meltwater channels, sometimes losing themselves in swamps or small lakes, or they follow a tortuous course through the hills.

Topography exercises a large measure of control on the upper reaches of the Rocky Saugeen. The curve of the Holland Ridge causes the course of the river to turn almost completely around from its original direction.

5. CONCLUSION

A variety of landforms and material moulded and deposited by glacial action covers the rocks of the watershed. These materials and forms constitute the dominating factor of soil and land use. They are also responsible for much of the pattern of surface drainage. Reference to the map of landscape types which accompanies this chapter will help in understanding the physical features of the watershed.

CHAPTER 3

GENERAL CONSIDERATIONS

1. THE PURPOSE OF THE SURVEY

A soil conservation survey is made to compile an inventory of soil resources and present use and to appraise the capabilities of the land. From this there

can be derived a pattern of land use which, if carried out, would adjust the use of the land more nearly to its capabilities. In this report a map of Recommended Land Use has been prepared.

2. METHODS OF SURVEY

The soil map of Grey County, prepared by the Soils Department, Ontario Agricultural College, formed the basis of the soil conservation survey. In addition, the soil types as described on the map were correlated with the landforms by field observation.

The mapping of the watershed was done on a reconnaissance scale. To get a detailed picture of the soil conditions, a sample strip was chosen which crossed a representative sample of the soil types and landforms which are found on the watershed.

In addition to identifying the soil types on the detail strip, the soil conditions were observed and recorded. These included the degree of slope, the amount of soil erosion that has taken place, the internal drainage of the soil and the intensity of stoniness and boulderiness. These conditions were mapped on aerial photographs, the smallest unit area being four acres. In addition, the present land use, whether cultivated, pasture, forest, or idle land, was mapped field by field. Supplementary sources of water, in addition to the farm wells, were also included in the survey. The knowledge derived from the detail study was used to estimate land use capability and to set up a reconnaissance classification of the whole watershed.

3. STUDY OF SIZES AND TYPES OF FARMS

Remedial measures to conserve soil and water on the whole watershed would be much wider in scope than those offered by individual farm plans. There is wide variation in type and intensity of land use and much land is marginal and submarginal economically. It was therefore necessary to map out regions of the watershed according to the use of wide areas. This was done in two ways. First, from township rolls the sizes of individual holdings were obtained and plotted on a map. Second, each farm was visited and by superficial examination was classified according to the apparent efficiency and capital outlay. This in no way can be applied to any one farm, for the capital value and efficiency of a farm are matters known only to the farmer himself, but reduced to a map which shows the general characteristics of farms in degrees throughout the watershed, this information throws much light on the conditions of the watershed as a whole.

4. DEFINITION OF SOIL

The soil is a living body. It is made up of unconsolidated mineral material, living micro-organisms and the remains of dead plants and animals. It is formed by the interaction of living things, on and within the soil, and air and water with the mineral material. The soil provides the medium for the germination and growth of the plants that man uses. The quality of a soil is measured in terms of its capability to support the crops that man wishes to grow on it.

The strongest influences in the formation of soil are climate and vegetation. The soils of the watershed have been formed under a moist, cool, temperate climate and a covering of hardwood or mixed forest. The soil-building process under these conditions is called "podsolization" and the group of soils thus formed is called "the Gray-Brown Forest (or podsollic) soils".

The process of podsolization in the building of a soil is as follows. Organic matter, leaves, dead wood and grass or any other vegetative product on the surface decays by microbial action. The activity of animals such as earthworms and rodents mixes the decayed organic matter (humus) with the mineral material. Decomposition of organic matter produces acids. These acids are leached downward through the soil by the excess rainfall of the cool seasons. From the soil below the point where humus and mineral matter is mixed, there are removed certain components, the lime and magnesia, salts of iron and the very finest particles, the colloids. This makes in the soil a zone of leaching.

Below the zone of leaching the downward action of the soil moisture is retarded and some of the components are redeposited. The iron compounds accumulate and give to the soil a characteristic brown colour. The colloids accumulate and make the soil stickier. At a greater depth, a foot or more depending on the nature of the ground and the climate, no weathering action takes place and the parent mineral material remains unaffected.

A cross-section of a soil will reveal these differences at different levels. Such a cross-section is known as a soil profile. The levels at which the phenomena described above appear are called "soil horizons". Combinations of the various factors affecting soil development will produce for each "soil type" a different profile with its own particular group of horizons.

5. SOIL CLASSIFICATION

The soils of Ontario can be grouped into associations, series, types and phases. Soils that are formed on the same parent material in the same land-form belong to the same "association" or catena. Within this group are found "series" that are said to be "associated". A "soil series" has the same profile development wherever it is found. The Ontario Soil Survey assigns names to soil series when it maps the counties. When a series is found that has not already been identified, a name is assigned to it, usually taken from the name of the locality in which the series was first identified. A soil series is recognized on the basis of the profile development according to the internal drainage of the soils in each association. Thus on the same parent material, a number of series may develop, ranging from a deep, excessively drained profile to a shallow, poorly drained profile.

6. SOIL CONDITIONS

The chief problem in soil conservation is to control the erosion of the soil and the consequent loss of water-holding capacity of the soil, and the accelerated surface run-off of water. It is necessary, then, in a conservation survey to deter-

mine what land is sloping and susceptible to erosion and what land has already experienced soil erosion.

In topography with regular slopes land is considered level when the slope is under 2 per cent, and usually requires no special management, unless the internal soil drainage is impeded. All other slope classes require special practices to control soil erosion and to conserve water.

7. METHODS OF FIELD EXAMINATION

The soil is examined in three ways. All existing road cuts, excavations and holes are first examined. Where the soil is covered by sod it is opened up with a tiling spade. When frequent examinations of the soil at some depth are required, an auger is used to penetrate and bring up samples of soil from a depth of three feet. Using these methods, soil material is easily examined and classified.

CHAPTER 4

DESCRIPTION OF SOILS

1. CLASSIFICATION

The formation of the soil is due to the action of weather and vegetation. On this watershed, as in the rest of Southern Ontario, the soil-forming process is that of podsolization, which was described in the introductory section on soils. Most of the soils of the watershed may be grouped together as gray-brown, podsollic soils. However, it will be remembered that the soil-forming process is one of leaching by moisture and acids and the removal of lime and magnesia carbonates. This process is opposed by the presence of limestone. The resulting soil is a compromise between these two influences. It is called a "Brown Forest Soil". There is a dark brown topsoil, little or no horizon of leaching and a brown subsoil. The profile is quite shallow.

Brown Forest soils are found sporadically throughout the watershed. There is no pattern to their occurrence, although they are more frequent in the northern sections than in the south. Often the two soil groups are found side by side with no area of transition.

The soil classification used in this report is that set up by the Ontario Soil Survey. The soils have been identified on the basis of physiographic origin—that is, landform and material. The soils formed on one kind of material form an association or catena. Series in a catena are separated on the basis of natural internal drainage. Following is a list of the major soil divisions of the Saugeen.

All soils on the Saugeen Watershed have rather shallow profiles, usually less than two feet in depth. In other words, there is a definite tendency toward immaturity. This is the result of two factors. The soils are somewhat younger than those of other parts of South-western Ontario. Secondly, the high lime content of the soils has tended to slow down leaching, thereby impeding profile development.

<i>Great Soil Group</i>	<i>Soil Type</i>	<i>Internal Drainage</i>	<i>Topography and Material</i>
Gray-Brown Podsolc	Harriston loam Harriston silt loam	Good Good	Drumlins and till plains, loamy material
Gray-Brown Podsolc	Listowel loam	Imperfect	
Gray-Brown Podsolc	Listowel silt loam	Imperfect	
Dark Gray Gleisolic	Parkhill loam	Poor	
Dark Gray Gleisolic	Parkhill silt loam	Poor	
Gray-Brown Podsolc	Pike Lake loam	Good to excessive	
Brown Forest	Sullivan sand	Good	Roughly sorted out- wash, coarse open material
Brown Forest	Sullivan gravel	Good	
Gray-Brown Podsolc	Donnybrook gravel loam	Good	
Gray-Brown Podsolc	Waterloo sandy loam	Good	Kames and outwash material well strati- fied
Gray-Brown Podsolc	Burford gravel	Good	
Dark Gray Gleisolic	Brisbane gravel	Imperfect	Spillways, gravel
Dark Gray Gleisolic	Gilford gravel	Poor	
	Muck	Poor	Spillways
	Peat	Poor	Swamps
	Bottom Land	No profile development	River valleys

2. THE HARRISTON SERIES

This soil series is characteristic of the Bentinck Whaleback Hills, the Durham and Markdale Rolling Plains, and the Dundalk Silty Plain. In the first three physiographic units Harriston loam predominates, while the Dundalk Plain is largely composed of Harriston silt loam. The topsoil of Harriston loam

consists of an A₁ horizon of 4 to 5 inches of grayish-black, crumb-structured loam, underlain by an A₂ horizon of 4 to 6 inches of light yellow structureless loam. Much of the coarser material has been removed from this horizon, leaving it silty in texture. The B horizon, or subsoil, consists of 8 to 10 inches of light brown nut-structured clay loam. Sometimes this horizon becomes rather blocky in structure and breaks up into large aggregates. The parent material is a gray-brown, stony, medium-textured till, which has a high lime content. Harriston loam is variable in stoniness throughout the profile and the stones are of varying sizes. The amount of stoniness also varies according to location, although Harriston soils are rarely excessively stony.

The profile of Harriston silt loam is very similar in appearance to that described above. The difference is that the soil has been developed wholly or partly in silt which has been deposited over the till. Thus the two soil types exhibit a similar profile development in depth and colour, but differ in texture.

Listowel loam and Listowel silt loam are the imperfectly drained members of the Harriston catena. They are marked by shallower profiles, somewhat darker in colour throughout, with the A₂ and B horizons marked by gray and brown mottling. This is caused by a fluctuating water table, allowing brown oxides of iron to accumulate during dry periods and reduced compounds of iron to accumulate during wet periods. The inadequate internal drainage limits downward movement of water, giving a shallow profile and a limited development of the A₂ horizon.

The poorly drained member of the series, Parkhill loam, exhibits a still more limited profile development. It consists of black topsoil, very high in organic material, underlain by a sticky gray, slightly mottled material called a glei. This is the result of a permanently high water table. Since the soil is permanently wet, it is of little use agriculturally.

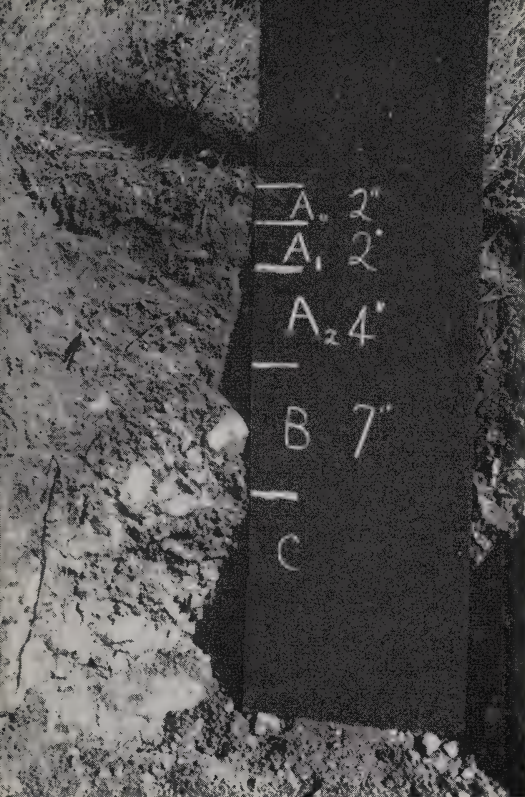
The natural vegetation of the Harriston and Listowel soils is a broad-leaved hardwood forest such as is still found on the steeper slopes of the drumlins. Where evergreens occur they either have been planted or have invaded an area that has been taken out of cultivation. The natural vegetation of the poorly drained Parkhill loams is typically cedar swamp.

Because of the good internal drainage of the Harriston soils and their relatively high lime content, soil erosion is not a serious hazard, except on the steeper slopes of the drumlins. The Listowel soils, on the other hand, because internal drainage is impeded, can erode rather severely if they occur on slopes. At the same time, their productivity is impaired because of the imperfect drainage. They are "cold" soils and do not dry up quickly in the spring unless they are artificially drained.

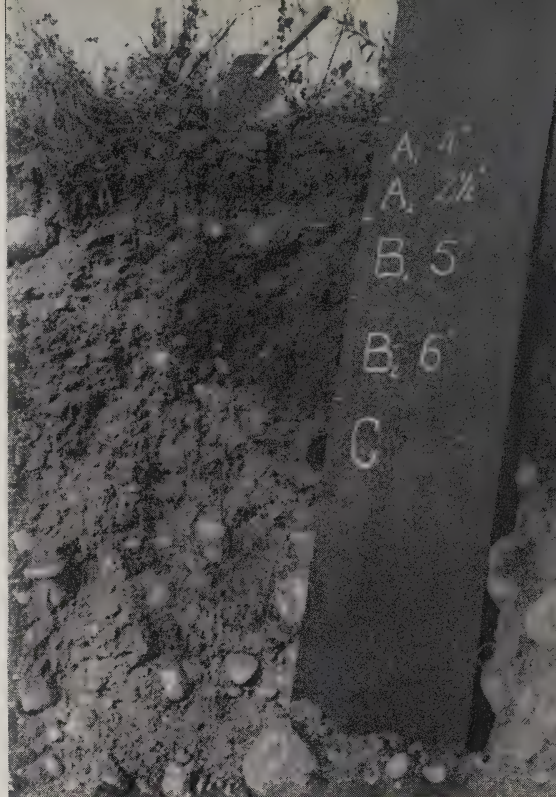
3. THE SULLIVAN SERIES

(a) SULLIVAN SAND

This soil type is extensive on the Hanover Plain and found occasionally in the Glenelg Gravelly Hills. It is a Brown Forest soil, having no evidence of a leached horizon. Sullivan sand profiles are shallow, varying from 10 to 15 inches. The A horizon is a dark brown sandy loam exhibiting a crumb structure



Harriston Loam. This is the most productive soil on the watershed and occurs most extensively on the Bentinck Whaleback Hills.



A soil profile of Donnybrook gravel. Note the coarse, stony nature of the soil.

Sullivan Sand. This is a brown forest soil and lacks a leached A² horizon. It is characteristic of the Hanover Sandy Plain.



when the content of the organic matter is at a high enough level. The subsoil is often divided into two separate horizons, B₂ and B₃. The B₂ is a dark brown crusty sand, the tendency to cementation being due to deposition of oxides of iron. The B₃ is a yellow-brown fine sand. The B horizon grades indistinctly into the parent material, a grayish-yellow calcareous sand, which shows stratification, indicating that it is water-deposited.

(b) SULLIVAN GRAVEL

This soil has a similar profile development to Sullivan sand, except that it contains a high proportion of fine gravel and the horizons are not so distinct. The parent material is a stratified gravel. It has the same general distribution as the Sullivan sand, except that it tends to be confined to the edges of the Hanover Undulating Plain.

The imperfectly and poorly drained members of the Sullivan series occur only in very small localized areas and are not agriculturally significant.

The natural vegetation of the Sullivan series is a mixed coniferous-deciduous forest. Conifers tend to predominate on the sandy knolls.

Because of the free internal drainage of these soils, erosion is not a serious problem if they are well managed. However, the profiles are shallow and unless the organic content is maintained at a high level, they can quickly become exhausted and extremely droughty. In this case wind erosion can be a severe hazard.

4. THE DONNYBROOK SERIES

DONNYBROOK GRAVELLY LOAM

This soil type is found in localized areas throughout the Glenelg Gravelly Hills and on isolated kames and eskers throughout the watershed. It is a Gray-Brown Forest soil, exhibiting a partly leached horizon. The profile varies in depth from 12 to 17 inches. The topsoil consists of an A horizon of fine sandy loam with occasional small stones, in which the mineral and organic materials are well mixed, giving it a very dark gray-brown colour. The A₂ horizon is shallow, only 2 to 3 inches in depth, and is composed of a fine gravelly loam, in which definite layering is visible. It is yellowish-red in colour and much of the organic matter has been removed by leaching or oxidation. The subsoil of B horizon is a gravelly loam, dark brown in colour. Sometimes two horizons can be detected, the upper one slightly darker than the lower. The parent material of the soil is stratified sand and gravel, and some of the stones appear to have been derived from Pre-Cambrian rocks. A few granite and gneiss stones appear throughout the profile which are foreign to the underlying bedrock. Donnybrook sandy loam is found on kames which are largely composed of sand. The Donnybrook soils exhibit a coarse open structure that allows free penetration of water, and are somewhat droughty. Since the slopes associated with them are often steep, erosion can be a problem if they are intensively cultivated. However, the rough topography often limits cultivation and large acreages of these soils remain in pasture and forest.

5. PIKE LAKE LOAM

This soil type is closely associated with the Glenelg Gravelly Hills and the Saugeen Swampy Flats. The materials from which these soils are derived vary greatly. Sometimes they are stratified and sometimes they are not. Regardless of the mode of deposition of the parent material, the profiles are all very similar in appearance. They are shallow, coarse and excessively stony. Sometimes the profiles are only a few inches deep. The stones are usually ungraded as to size, varying from large boulders to small pebbles. These soils have a low organic content and are rather infertile and droughty. The topography associated with them is rough and broken and this combined with their excessive stoniness makes cultivation very difficult. Therefore, much of the area covered by this land type is in forest or supports very poor pasture. A similar type of soil to Pike Lake loam, but belonging to the Brown Forest group, is also found in some parts of the watershed. It is called Osprey loam. The profile is the same except that a horizon of leaching cannot be detected. Both soils are almost structureless in the upper horizons, with a slight tendency to crumb structure in the subsoil. The stones tend to become encrusted with lime.

6. WATERLOO SANDY LOAM

This is a characteristic light-textured soil found particularly on flanks of the kames south of Allan Park and its distribution on the watershed is therefore limited. Waterloo sandy loam has a loose black topsoil which shades into a pale yellow dusty sand. The subsoil is bright yellow shading into brown and is underlain by gray stratified sand of the parent material. The parent material is quite high in lime, although it has been leached completely out of the profile.

The soil is well drained, light and easy to cultivate. It is a "warm" soil and can be worked early in the spring. However, since it is a light soil, the organic material is soon "burned" out under cultivation and requires constant replenishment. On the steeper slopes, erosion can be a severe hazard, thereby increasing the tendency to drought.

Despite its disadvantages, this soil type is extensively cultivated. It is more fertile than the accompanying gravels and in addition is much easier to cultivate. Properly managed and fertilized it can produce excellent crops.

7. BURFORD GRAVEL

This soil type is confined to the Saugeen Swampy Flats, on the better drained fringes. The parent material is a well stratified gravel, deposited through the action of glacial meltwater streams. The topsoil is usually a mixture of sand and gravel with enough organic matter to produce a loamy texture. The subsoil is a dark brown stratified gravel and is often slightly cemented to form a hard layer.

Burford gravel has a very restricted occurrence and due to its proximity to swamps is often left either in forest or pasture. However, it responds to cultivation better than do the coarser soils. The areas covered by this soil type are often valuable sources of gravel.

Where the drainage in the Flats is poor a soil called Gilford loam is found. It is developed on the same parent material as the Burford, but is constantly

wet. The profile is shallow and consists of a surface layer of black decomposed organic matter, underlain by a stony, sticky gray horizon, slightly mottled with red, called a glei. Again the stratification of the gravel is evident. These soils cannot be drained adequately and therefore remain in forest cover, mainly cedar swamp.

8. MUCK AND PEAT AND BOTTOM LAND SOILS

In areas of poor drainage, in depressions, the bottoms of spillways, and in inter-drumlin areas, the excess moisture slows down decomposition of plant matter so that there are considerable accumulations of muck and peat. Since they are poorly drained, they are used mostly for summer pasture and for woodland.

Where the main streams and some of their tributaries flow through broad valleys, the valley bottoms are subject to floods, especially in the spring. The soils in these valleys are silty and covered with recent deposits of sediments, so that there is little or no profile development. They therefore cannot be assigned to any particular soil zone. They are also poorly drained. Because of the poor drainage and periodic flooding these soils are unfit for regular cultivation and are usually covered by pasture or woodland. They are lumped together under the general term of bottom lands.

CHAPTER 5

PRESENT LAND USE

1. TYPE OF AGRICULTURE

Farming on the Saugeen Watershed is mainly of the mixed farming type. That is, the farm income is usually derived from more than one source. Cattle-raising is probably the most important of these sources. Cattle-raising serves two functions, beef production and cream production. Only a very few farms are devoted primarily to the production of fluid milk, and they are confined to the areas near the towns of Hanover and Durham and the village of Markdale.

Farm incomes are supplemented by hog-raising and poultry-raising, and in some cases, sheep-raising. A few farms specialize in poultry farming, notably turkey-raising. There are few examples of cash cropping on the watershed. Some wheat is grown around Hanover and Edge Hill and flax is grown sporadically throughout the area, especially in Glenelg Township. Clover seed is also produced as a cash crop. Census figures are not obtainable for a watershed area, but since the Townships of Glenelg and Bentinck are almost entirely within the watershed, it is possible to obtain a good picture of the agriculture by referring to the census figures of these two townships.

In the Census of 1941, there are 936 occupied farms listed in Bentinck and Glenelg. Further breakdown on farm types cannot be derived from the census but the figures on farm conditions, crops and livestock indicate that income is derived mainly from livestock, sometimes supplemented by forest products.



The chief grain crop on the watershed is oats, like this good field in Glenelg.

Much of the rougher land of the watershed is left in unimproved pasture. Improvement of these pastures would greatly increase the carrying capacity and afford more protection to the soils. Artemesia Township.

Hay occupies a large acreage of the individual farms.



2. CROPS AND LIVESTOCK

Again, the agricultural census of 1941 for Glenelg and Bentinck Townships may be used as a guide to the overall picture of agriculture on the watershed. There were over 47,000 acres of field crops in the two townships, of which hay made up nearly one half. Oats has the largest acreage of the grain crops, with mixed grain, wheat and barley following in that order. However, these three crops combined occupy only three-quarters as much land as oats. Rye, flax, fodder crops (corn, etc.) and potatoes occupy a very limited acreage.

There is about the same amount of land in pasture as there is in field crops. Over half the pasture is classed as unimproved land, that is, not fit for the plough. Woodland and marsh occupy over 37,000 acres of the unimproved land.

The figures on cattle are rather more difficult to evaluate. Cows and heifers (over one year) are slightly in excess of those kept for beef and young stock (10,000 to 9,000). However, these figures do not always include stockers which are bought for either winter or summer feeding. There are only about 4,500 cows milked in the two townships. The number of cattle per square mile is low compared to some of the other townships of Ontario. The number of sheep and swine listed in the 1941 census is also low, 7,800 sheep and 8,600 swine. The 1951 census should show a considerable increase in the number of swine, due to increased production during the war and the relatively high price of pork since the war.

3. PASTURE STUDY

A study of existing improved pastures on the watershed was made in order to obtain information of the measure of success in the establishment of pastures under different soil conditions. The study included type of mixture used, soil type, slope and drainage, management, carrying capacity and length of time seeded down. To get a comparison, some unimproved pasture farms were studied.

There are a number of long-term improved pastures in existence on the watershed, the majority of which have been quite successful. The largest operator is at Hanover, who has three plots which have been seeded down for varying lengths of time. The soil type is mainly Sullivan sand, but despite the tendency to summer drought on this soil, the plots maintain a good growth throughout the season. One plot has been seeded down for six years and still produces a heavy sod and large quantities of fodder. The most successful mixture has been orchard grass, brome grass, meadow fescue, Kentucky blue grass, Canada blue grass, ladino clover, red clover and alfalfa.

The plots are manured and fertilized regularly in spring, fall and winter. Phosphate at the rate of 200 pounds per acre together with a concentrated nitrogen fertilizer is added in the spring and 200 pounds to the acre of 0-12-20 fertilizer in the fall. The plots are clipped regularly to prevent coarse growth and to keep down the weeds. It has been found on these plots that the red clover disappears after the second year and that the alfalfa becomes very thin after three or four years.

Another very successful pasture has been established near Priceville on rough hummocky land, which had been rather seriously eroded. The soil type

is Donnybrook gravelly loam, which is light and well drained and tends to be droughty in the summer. Unimproved pastures in the same area are usually dried up and brown by the middle of July.

The mixture used in this pasture is orchard grass, brome grass, Kentucky blue grass, alfalfa, ladino clover and white Dutch clover. It has been seeded down for four years and has a carrying capacity of two head of cattle per acre, until September. The pasture is clipped regularly and manured during the fall and winter. 12-48-24 fertilizer is applied at the rate of 60 pounds per acre in the spring. The pasture is not grazed late in the fall, so as to allow a good growth before winter to prevent winter killing.

A successful long-term pasture has been established near Markdale which has been seeded down for six years. The soil type is a light Harriston loam which is very stony and the land is too hilly to be economically cultivated.

The mixture used here is slightly different from the preceding one. Timothy has been substituted for white Dutch clover and Canada blue grass has been added. This pasture carries 16 head of cattle on 16 acres all summer. The area is divided into four-acre plots and grazed in rotation. Cattle are put on the pasture the first or second week in May, always a week before the neighbouring cattle. They are taken off early in the fall to allow for pre-winter growth. The pasture is manured in the fall and fertilized in the spring with 100-200 pounds to the acre of 2-8-12 or 2-10-12 fertilizer.

By contrast, the unimproved pastures studied have a much lower carrying capacity, averaging about one head to four acres. All are becoming badly infested with weeds and the desirable species of grass have been largely killed out. All suffer from drought during the summer months.

The study indicates that the establishment of long-term improved pastures is quite feasible on the watershed. All operators are satisfied with their pastures and feel that the extra costs of management are more than compensated for by the added returns. The establishment of long-term improved pasture is one of the best soil conservation practices which can be adopted on the watershed.

4. LAND USE MAPPING

Five classes of land use were recognized and mapped on the land use survey. They were as follows:

- (a) Cultivated—field crops, pasture, hay or fallow, included in a crop rotation.
- (b) Pasture—unimproved land used for grazing, "wild" pastures and pastures which had been seeded down for more than five years (that is, longer than an ordinary crop rotation period).
- (c) Woodland—forest which is recognized as woodland in the forestry survey.
- (d) Idle land—not carrying woodland and unsuitable or unused for cultivation or pasture.
- (e) Urban land—contained within municipalities or built up.

Land use was mapped on a reconnaissance basis by blocks. The land use was observed and the percentages of each estimated. In preparing the map, each block was assigned to a class as follows:

- Cultivated.....more than 60% cultivated
- Pasture.....more than 60% pasture
- Forest.....more than 60% forest

Since idle land is not extensive on the watershed, it was not included as a class.

- Cultivated and pasture
 - Cultivated and forest
 - Pasture and forest
 - Cultivated, pasture, forest and idle—where no two classes add up to 60%.
- } When any two add up to 60%

The largest class of land use on the watershed is that of cultivated and forest. It is prevalent throughout the Holland Ridge, the Bentinck Whaleback Hills and the Glenelg Gravelly Hills, and indeed forest dominates in many of the blocks throughout these areas. Cultivated blocks tend to be confined to the Hanover Rolling Plain and the Durham, Markdale and Dundalk Plains. Blocks of pasture or pasture and forest are more widely scattered. The land use map clearly shows that climatic and soil conditions of the watershed are such that forestry is still an important factor in the land use of the watershed. The census figures clearly show that hay and pasture far exceed all other crops in total acreage. The great extent of sod and the importance of livestock on the farms are both features which favour soil conservation. Increase in agricultural production and protection of the soil both depend on accepting the basic principles of livestock and sod. Where land must be cultivated for corn, roots, grain or cash crops, it must be protected against erosion and its fertility and organic content kept up. A balance between high yields of field crops, without robbing the soil, and good pastures is the summary of soil conservation from the farm point of view. From a regional point of view, the withdrawal of some land from agricultural use and putting it back into forest with the view of harvesting a crop of timber is the chief principle.

CHAPTER 6

CONSERVATION PRACTICES

Conservation means using and managing land according to its use capability. It emphasizes management to combat the loss of water and soil erosion, and at the same time to maintain good crop yields. The various methods used to this end are herein described.

1. CROP ROTATIONS AND COVER CROPS

The most effective means of combating water loss and soil erosion is the maintenance of good soil organic content. Soil with organic content absorbs water and retains it and makes soil fertility readily available to plants. Organic matter is commonly added by crop rotation, application of animal manure and

the ploughing under of a crop of clover or grass as green manure. Trash, stubble and straw also play their part if nitrates are added to aid in their decomposition.

Grains and intertilled crops such as corn or potatoes are classed as soil-depleting crops while grasses and legumes are classed as soil-building crops. The legumes combine nitrogen from the air into the soil and the grasses leave the remains of their root systems in the soil and when the sod is ploughed under some of the vegetation is turned into the soil to enrich it. The decaying vegetation improves the soil structure and provides a sponge which absorbs water readily.

In the areas which are more susceptible to erosion and on which the slopes are too irregular to practise contour cultivation and strip-cropping, it is usually better to extend the crop rotation so that the land is cultivated only once in four years or more. The extra strength built into the soil during the years it is under the grass cover will make it much less susceptible to erosion when it is cultivated, and yields of cultivated crops are increased. Under this system intertilled crops should be kept to a minimum on the sloping land.

Much of the sheet and rill erosion takes place in the fall after ploughing is completed or in the spring before the crop is established. This condition can be controlled by vegetative cover, and where land is under sod or is planted with winter grains, this is accomplished automatically. It is advisable, on land which might otherwise be left fallow over winter, to seed to a winter cover crop such as rye. Winter cover crops protect the land against erosion and constitute a means of adding organic matter to the soil. The difficulty is that the winter cover crop must be planted early in the fall so that it will be far enough advanced by the first frost to be really effective. This cuts down the number of fall cultivations and creates a problem of tillage during a late spring.

2. IMPROVED PASTURE

Long-term improved pasture is applicable on land which is too rough and eroded to be economically cultivated. It is especially applicable on light soils which quickly lose their fertility under continuous cropping. Good pasture serves two functions: it acts as a soil-building agent; and secondly, the thick grass cover protects the soil from erosion by slowing down the surface run-off of water and allowing it to seep into the ground. A good improved pasture is an economic asset to a farm and is reflected in the production of beef and milk. To establish long-term improved pasture, good preparation of the seed bed is essential. Weeds may have to be eradicated by spraying before the old sod is broken up. The area should be cleared of boulders and of any brush and small trees. The old sod must be broken up and re-seeded to a good pasture mixture, the major species of which are capable of remaining productive in the ground for a long time. Manure and commercial fertilizer should be applied to give the young seedlings a good start. Seeding may be done either with a cyclone seeder or the seed drill, using the clover seed box for the small seeds and the grain box for the larger seeds. The spouts should be removed from hoes in order to get a broadcast effect and to avoid deep planting. The common practice is to seed a nurse crop along with the pasture mixture in order to protect the young seedling.



Improved pasture is one of the best soil conservation measures which can be carried out on the watershed.



A grassed waterway in a field of grain is good farming practice and good erosion control.



On smooth slopes, alternate strips cultivated "on the level" save soil and water.

There is little information to be had on pasture renovation in Ontario. Some good results have been obtained by applying fertilizer to existing pastures and clipping regularly to keep down weeds. In this way a thick stand of grass has been established. This type of management may be used to good advantage where the land is too rough to be tilled. It is especially applicable on light soils, but cannot be used to advantage on heavy soils where subsoil compaction has taken place.

Good management is essential to the success of any long-term improved pasture. The pasture should be fertilized with commercial fertilizer in the spring and should be top-dressed with five to ten tons of manure per acre in the spring and fall. Grazing must be controlled, so that it is neither overgrazed nor undergrazed. It is a good practice to divide the pasture into plots and graze them in rotation. Regular clipping is essential to control weeds and to prevent rank, coarse growth. This should be done at least twice during the season, once for early and once for late weeds. The mowing should be done before the weeds go to seed.

On farms that are more seriously eroded the establishment and maintenance of good pasture is the most important single remedy. Complete instructions on pasture mixtures and the establishment and maintenance of pastures may be obtained from "Better Pastures in Eastern Canada", published by the Department of Agriculture, Ottawa, and from "Better Ontario Pastures" and "Good Seed Mixtures for Hay and Pasture in Ontario", published by the Ontario Department of Agriculture. Advice and assistance can also be obtained from the County Agricultural Representative.

3. CONTOUR CULTIVATION AND STRIP-CROPPING

The principle of contour tillage is that each furrow or drill row, being "on the level" instead of up and down, acts as a tiny dam and checks the downhill flow of water. Furrows, drill rows or even the tracks of implements running up and downhill channel the water downhill. The rapidly moving water soon gouges out rills. These are often seen after a heavy rain or, more commonly, during the spring thaw. These rills are smoothed out with subsequent cultivation, but nevertheless some soil is lost. Some of the rills may grow into gullies. By cultivating on the contour this difficulty is overcome and the water penetrates the soil instead of rushing down slope to be lost, taking good topsoil with it.

On very gentle slopes, cultivation across the slope will usually suffice. However, with the steeper slopes contour cultivation must be combined with strip-cropping. By this principle alternate bands of cultivated and sodded land are laid out across the slope. Some surface run-off will occur on the cultivated land regardless of the way in which it is cultivated and the sod strips, therefore, act as buffers and pick up any soil eroded from the strips next to them. At the same time, the grass cover builds up the organic content of the soil and thereby adds to its fertility. When there is more organic content in the soil, absorption and retention of water is increased and erosion decreased. In practice it is necessary to have crop rotations which include two years of sod for every two years of grain or corn, as for example, hay, hay, corn, oats. Thus the cultivated

strip is left open for two years, while the sodded strip remains under grass for two years. Half-way through a four-year rotation the sod is ploughed up and the cultivated strip is seeded down to hay.

Contour cultivation and strip-cropping are only applicable on long smooth slopes, such as are found on the Bentinck Whaleback Hills. There is a further disadvantage to contend with in this area. Much of the land on these hills was bouldery and stone fences were commonly built of boulders removed from the fields. Therefore in order to lay out the contour strips it would be necessary to remove these fences by means of a bulldozer, which would add greatly to the expense of instituting a farm plan incorporating contour strips. Once a farm is set up for this type of farming the land becomes easier and cheaper to work, especially with mechanized equipment. Contour cultivation is much more economical of power than the conventional method. Tests have been made of this type of farming which show that operating costs have been lowered and returns increased in the first few years of operation.

4. TERRACES

A diversion terrace consists of a channel running across the slope which may be cultivated or left in grass. This intercepts overland flow of water about half-way down a slope and diverts the flow along the contour. The outlet of the terrace should lead to a grassed watercourse along which water can be carried safely downhill.

Diversion terraces may be constructed along with a system of strip-cropping to break up long, smooth slopes. They may also be used to break long slopes which are too irregular to be strip-cropped. This device by itself can commonly be used and should be sufficient to check a good deal of soil and water loss on land that does not lend itself to systems of contour cultivation.

Any practice carried out on the contour should be undertaken only under direction of a trained agricultural engineer or soil conservationist. Faulty layouts may lead to trouble, and failure of a scheme purporting to be for soil conservation can seriously prejudice people against it. Once these practices are thoroughly understood in a district and men are available who are experienced in them, the need for technical assistance lessens and only guidance and inspection by professional people are necessary. In this regard, the setting up of a demonstration farm serves two purposes. It proves the worth of this type of farming to the district and also gives experience to local people in the methods of conservation farming.

5. GRASSED WATERWAYS

By this method, all definite watercourses, that is, watercourses which carry water in the spring and after heavy rains, are kept under permanent sod. The sod checks erosion and gullyng. Silt, which may be washed from bare earth, is trapped by the grass and its fertility is not lost to the farm. Clear water is delivered into the streams to the benefit of fish and wildlife and other users of water.

The grass which grows on the waterways can be cut and used for hay. It is worth while to leave a wide enough strip to run a mower up and down. The

grass can be expected to grow well because of the fertility added to it each year by the soil washed from the field.

6. GULLY CONTROL

Gullies are not extensive on the watershed. Some are in the form of erosion scars on steep slopes which have been aggravated by wheel tracks, cattle paths or dead furrows running up and down hill. Others are due to headward erosion of intermittent streams. Besides the loss of good topsoil, speeding up the run-off and adding silt to the streams, ditches and reservoirs, these gullies have the further disadvantage of obstructing the tillage of fields crossed by them. Some gullies are small enough to be checked by cultivation and seeding to grassed waterways. Larger gullies may need check dams to hold back the water and allow the gully to gradually fill up again. Alternatively, the gully may be filled with brush and earth graded over it. Re-excavation can be prevented by several methods. Interceptor ditches, terraces or drains may be used to carry the run-off away from the head of the gully or tile drains may be laid along the bottom before back filling takes place.

If the gully is too large to be completely filled up and returned to cultivation, it should be rendered harmless and protected by trees, shrubs and good sod cover.

7. DRAINAGE

Soils which suffer from poor internal drainage cannot be brought to maximum production unless they are artificially drained. Plants need both air and water for proper growth, but if the soil is full of water, most of the air will be driven out and the plants will suffer from lack of oxygen.

In most imperfectly drained soils, the soil water table is high in the spring and drops later in the season. For this reason, seeding is usually late and the plants themselves develop a shallow root system. Then when the water table drops later in the season they may actually suffer from drought.

This condition can be overcome by the installation of tile drains. By this method the excess "gravitational" water is removed, leaving only the "capillary" water in the small spaces between the soil particles. At the same time the soil organic matter should be maintained at a high level by means of barnyard and green manure to improve the soil structure. A high organic content allows the soil to absorb moisture without becoming waterlogged. Where tile drainage is not possible, wet soils can be somewhat improved by this method.

Drainage of wet soils requires an adequate outlet for tile, which usually is accomplished by constructing ditches leading to watercourses. Sometimes this is impossible due to topographic difficulties. If this is the case, land use on the wet soils must be such as to take their limitations into account. This means concentration on grasses and legumes tolerant of moist conditions and a reduction of grain acreage.

8. WOODLAND MANAGEMENT

Due to climatic, soil and physiographic factors, a well managed farm woodland is one of the most important land uses of the watershed. Cattle should be

excluded from woodlots in order to promote a good undergrowth and to allow for the re-seeding of hardwoods. The loss of pasture acreage in the farm woodlot can be compensated for by the establishment of long-term improved pasture.

9. FARM PONDS

Good management of water resources requires holding water as much as redistributing surplus water. One aim of soil and water conservation is to hold moisture in the soil. Also important is adding to ground-water supplies and conserving water in surface reservoirs wherever feasible.

A multitude of surface reservoirs can materially increase the water which soaks through the soil into ground water and can also hold back the streams. These surface reservoirs can be in the form of farm ponds. Ponds are usually built for specific needs—fire protection, stock watering, domestic or barn supply, recreation and so on. The cumulative effects of many ponds on ground water and stream flow would be a benefit to all.

A bulletin on farm ponds is available from the Saugeen Valley Conservation Authority or from the Department of Agriculture. Six types of ponds are described, the dug-out, spring-fed, by-pass, run-off and ponds formed by permanent dams and temporary dams on permanent streams. Four of these types have a special application to the Saugeen Watershed—the dug-out, the by-pass, spring-fed and the pond on a permanent stream.

CHAPTER 7

LAND USE CAPABILITY

1. BASIS OF THE CLASSIFICATION

The use capability of the soil depends on its natural, inherent characteristics. It can be judged in two ways: first, from the experience of those who have operated it for generations; and second, from the knowledge of the characteristics of soil obtained by scientific analysis. The present land use patterns express pretty well the experience of farmers on the soils for at least 100 years. This gives the first clue to a comparative rating of capabilities. On the other hand, economic pressure, lack of technical knowledge or mere geographic location may have led farmers into using land in a way which slowly and insidiously wastes its resources. Therefore, to the knowledge of the worth of soils gained locally there may be added whatever is known regarding soil erosion and fertility depletion and methods for controlling them.

2. DERIVATION OF CAPABILITY RATING ACCORDING TO PRESENT USE

To determine the use of each kind of soil an area through the middle of the watershed was studied in detail. This area was chosen in such a way as to give a fair sample of all soil types and relief conditions encountered on the watershed.

The following soils were found:

By-pass pond, Glenelg Township. This pond should be fenced from cattle to maintain its usefulness.



Spring-fed pond, Ben-tinck Township.

Pond on a permanent stream. Headquarters, Grey County Forest.



Excessive stoniness creates problems of tillage. The organic content of such soils is usually low, resulting in low yields. Bentinck Township.



Bouldery soils like this in Holland Township are difficult to cultivate with modern equipment and should be left in pasture or reforested.

Inadequate drainage. These soils must be artificially drained to raise their productive capacity. This is near Proton Station.



Pike Lake loam
 Harriston loam
 Listowel loam
 Parkhill loam
 Sullivan sand
 Donnybrook gravel

Waterloo sandy loam
 Burford gravel
 Brisbane gravel
 Gilford gravel
 Harriston silt loam
 Listowel silt loam
 Parkhill silt loam

All these types of soil were recognized on the detail strip, totalling 30,108 acres. These are all soils which are used to a greater or lesser extent for agriculture. Slightly over 50 per cent is cultivated, the remainder is fairly evenly divided between pasture and woodlots, with a small proportion idle or covered by building lots.

On most of the soils listed there is a fairly good correlation between the use and the capability, although some of the acreages are too small to be considered good statistical samples.

For each type and condition of soil (combination of slope, erosion and boulderiness) the proportions under cultivation, pasture and forest were determined. As an example, on the Pike Lake loam it was found that it was cultivated more than the average only when conditions were most favourable. As slope, erosion and boulderiness increased there was less land under regular cultivation.

On the Harriston soils, presumably the best in the area, it was also found that as slope and erosion increased the land is used less intensively.

Although the steeper land and the more severely eroded soils are recognized as being less suitable for cultivation, an analysis of the study shows that they are, nevertheless, cultivated. This is where farm planning for soil conservation would be a good thing. The milder slopes can be protected from erosion by planting on the contour and in strips, or by extended rotations. Steeper slopes can be protected by maintaining them under sod for pasture. A good example of this practice on the watershed is a demonstration pasture seeded by Mr. Neil Aldcorn in co-operation with the Grey County Crop Improvement Association.

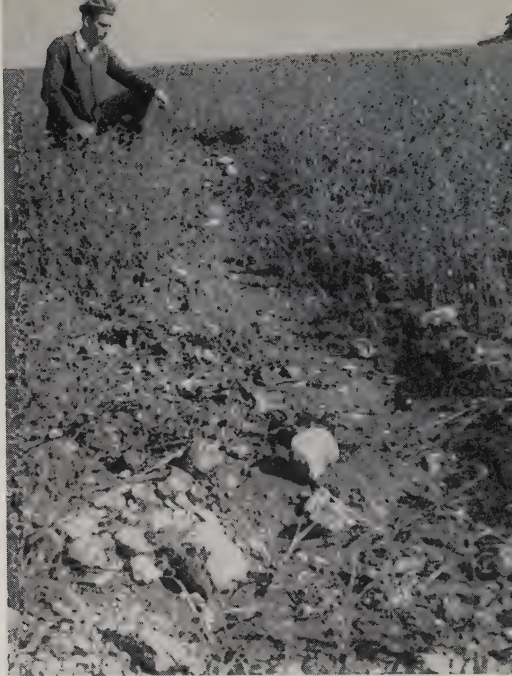
Most of the soils which have a high proportion under cultivation can be assumed to have a high capability rating, although some of them require some degree of protection against erosion or depletion. To set up a "capability rating" of the soils on the basis of present use, a simple calculation was made. The percentage of the soil which is cultivated was divided by 51.9, the percentage of the total area cultivated. For example, Harriston loam on slopes 5 and 10 per cent with moderate erosion, which is 71.4 per cent cultivated gives $\frac{71.4}{51.9}$

or 1.37. This was done for all the soils on the sample strip on which the acreage was considered to be a good statistical sample and these were listed in order of their capability rating.

3. CAPABILITY RATING

A list of the soils of the sample strip in order of their capability rating was prepared, based on present uses with notes on their advantages, disadvantages and proposed conservation farming practices and treatment with fertilizers.

Gully erosion on a smooth slope. This gully is just beginning and can easily be remedied by constructing a grassed waterway.



Rill and sheet erosion, showing the deposition of soil wash at the foot of the slope.



Erosion scars on a steep slope. This land is too steep for cultivation, but serious erosion has taken place with the removal of tree cover, and overgrazing.



The figure calculated for each type is obtained in the manner described above, that is, the percentage of the land type which is cultivated is divided by the average cultivated land (51.9). This may be called a "preference factor". A soil which is cultivated to the same extent as the average will have a factor of 1.0. Soils with factors greater than 1.0 are "preferred" by farmers in proportion to the factors and those less than 1.0, that is, cultivated less than average, have not been found, in the light of past experience, as suitable for cultivation. In many instances they are cultivated only where the operator has no better land to use. The preference factor gives a rough guide to the capability rating of the soil.

Out of the 29 soil types and conditions studied, two-thirds have a capability rating greater than 1, that is, they are cultivated to a greater extent than the average for the watershed. In all cases but one the capability decreases as the slope increases.

The study showed that the Harriston loams and Harriston silt loams are among the most preferred soils of the watershed. The former show a higher capability rating based on preference factor than the latter when they are well drained, but when the drainage is imperfect the conditions are reversed. This may be due to the relatively small acreage of Harriston silt loam as compared to Listowel silt loam, its imperfectly drained associate. The farmer on the Dundalk Plain is rarely able to make a choice, since imperfect drainage predominates.

The sands and gravels also show a high capability rating where the slopes are gentle. However, cultivation of these soils seems to decrease rapidly with the occurrence of steeper slopes. In all cases Pike Lake loam shows a low capability rating. This is also true for the poorly drained soils, the muck and the bottom land. All the latter soils are therefore of limited agricultural value and it would not be wise to clear any more land of trees in these areas. Rather, existing woodlots should be protected from grazing and fire and allowed to grow up and possibly extend by natural seeding. The Pike Lake loams especially tend to dry out when bare, but they will hold moisture to feed springs and streams when covered by good forest. Large acreages of these soils have been recommended for acquisition by the Authority for the purpose of reforestation (see Forestry Section).

The occurrence of boulders is the final limiting factor to the use capability of the soils of the watershed. While the areas in which this condition is evident are not extensive, there are local patches in which the boulders are numerous enough to preclude cultivation altogether. Usually they take the form of large limestone blocks deposited by glacial action, although they are occasionally due to outcrops of bedrock. If boulders are not too numerous, they can be removed with a bulldozer, thereby raising the agricultural capability of the soil. This method is unfortunately rather expensive so that areas of extensive boulderiness would be better returned to forest cover.

4. THE USE OF THE CAPABILITY RATING

The last chapter outlines recommended land use on the watershed. The capabilities of the soil, as determined in this chapter and in the detail survey,

form the basis of recommended patterns of land use. It should be understood that the recommended use cannot be based entirely on the natural characteristics of the soil. The location of any piece of land with respect to markets for farm products and with reference to other soils may determine its use. The types of management indicated are those which will sustain or increase production without further depletion of the soil.

CHAPTER 8

LAND ECONOMICS

1. PURPOSE OF ECONOMIC STUDIES

The size of farms and their prosperity and efficiency are indications of the capability of the soil. These factors were studied as a help in estimating the soil capability regions.

A conservation program might call for a change in land use in some areas so that use is better adjusted to capability. In some instances forestry might replace agriculture. On the other hand, demonstrations of soil conservation would be promoted in areas where new farming practices would help preserve soil and moisture. Therefore it is necessary to know where the "good" farming land and where the "poor" farming land can be found. The economic studies were carried out to establish these facts.

The findings of a survey of farms cannot be related directly to a map of the soils, because farm and soil boundaries do not coincide. A comparison of farms and natural conditions can be made on a regional basis. If, for instance, in a region in which one type of soil predominates, there are found only a few large farms of doubtful efficiency and prosperity, it may be safely concluded that that type of soil is of low capability. On the other hand, if an area is found in which the farms are mostly small but prosperous, and another soil type predominates in the area, that soil can be taken to be one of high capability.

Of course this correlation is not one hundred per cent perfect. A survey of this type must perforce ignore the human factor. The man who owns and operates a farm knows pretty well what kind of soil he has and what its capabilities are. Through wise management a man may operate an efficient farm and make a good profit on a soil of relatively low capability. On the other hand the occasional poor and inefficient farm may appear in a good soil area, due to unwise and faulty management. The human factor will inevitably produce anomalies in this type of survey.

2. SIZE OF FARMS

As a general rule, the size of farm holdings depends on the type of agriculture, the type of soil and the climate. Where soil and climatic conditions are such that fruit farming is possible, a small acreage can support a family. Mixed farming requires a larger acreage, ranching still more and forestry the largest of all. Generally speaking, the poorer the soil, the larger the area required to make a living. Over the years the interplay of natural and economic influences

should lead to the point where small holdings are firmly established on good land and large holdings on poor land. Small holdings *may* be found on areas where the land is not good enough to sustain commercial farms but where a "subsistence" level of farming may be carried out on small acreages and the farm income supplemented by work off the farm such as construction or bush work.

One factor works against this adjustment to natural conditions. With modern methods of mechanized farming, the natural tendency is to consolidate holdings. The man most able to do this is a prosperous farmer in an area of good soils. The operator whose farm is in a poor soil area is often unable to raise the necessary finances to extend his holdings. Also, consolidation of farms often results in cultivation of only a small part of the increased holding, the rest being retained as pasture. However, very large holdings are generally indicative of a low capability soil.

The size of farms was obtained from township rolls. This information was made available by township officials. The size of individual farms is irrelevant and no report is made of them here. Farms were found to be of all sizes, but on grouping them together it was found possible to account for them in the following way:

<i>Division</i>	<i>Acres</i>
Small.....	0-120
Medium.....	121-240
Large.....	241-360
Very large.....	Over 360

On a small-scale map of the watershed each farm was indicated in one of four divisions. When an area could be outlined in which more than 90 per cent of the farms are small, then that area was designated as one of small farms. By the same process areas of medium, large and very large farms were separated. One difficulty arose in this respect. Many of the holdings on the watershed were widely separated. Therefore, if a farmer owned one hundred acres in a small farm area, and another one hundred, five miles away in another small farm area, the consolidation could not be shown. In cases like these, it was assumed the two farms were operated more or less individually.

The map of farm size shows that the holdings are in a considerable state of flux. The small farm, one hundred acres usually, is still in the majority, while small and medium-sized farms make up by far the largest area. There are few farms in the very large class. On the Bentinck Whaleback Hills and the Hanover Sandy Plain, the farms are mainly of the small and medium-sized types. The soils in these areas, sands, gravels and loams, are such that they permit a good variety of crops to be grown. In particular, these areas are the only ones in the watershed in which wheat can be grown as a cash crop.

The Holland Ridge and the Glenelg Gravelly Hills have the most large farms of the watershed, reflecting the lower capability of the soils. An odd feature of the Glenelg Gravelly Hills is the relatively small number of medium-sized farms. The same condition occurs in the Markdale area. In the Dundalk

Plain, the farms are again medium to small in size. However, throughout the watershed it is very difficult to get an area of one size large enough to correlate with the soil type.

3. CLASSES OF FARMS

Where land is highly productive it is usually found that farms are efficiently run and economically prosperous. That is, the accumulation of capital from profits in good times makes possible good buildings, good herds and the provision of services such as hydro and telephone. There is then a tendency for these farms to be run most efficiently with mechanized equipment, improved herds and use of electricity.

Land of lower inherent capability supports farms which cannot afford the same amenities as the more prosperous farms. Individually they may be capably and efficiently operated, but as a group they do not represent the most efficient and productive form of agriculture.

Farms were rated on a point system which evaluated the fixed factors of production of the farm and the state of production at the time of inspection. The maximum number of points that it was possible for any one farm to obtain was arbitrarily set at two hundred. Of this total, one hundred and fifty or seventy-five per cent were based on fixed factors of production. Only fifty points or twenty-five per cent were based on variable factors of production. Farm buildings, one of the fixed factors of production, were given a maximum of one hundred points or fifty per cent of the total. In essence, this meant that the overwhelming determinant of the farm class was buildings.

Using this system of points, five classes of farms were recognized. They are listed below.

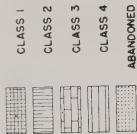
<i>Class</i>	<i>No. of Points</i>	
I.....	150 plus	75%
II.....	120-150	— 60-75%
III.....	120-120	— 50-60%
IV.....	less than 100	
AB—Farm buildings abandoned		

To produce the accompanying map each farm was visited and assigned to one of the five classes and the symbols plotted on one-inch-to-one-mile topographic sheets. The material was then put together and grouped according to the farm lots as indicated on the county map. In reading the map, if an area is seen which is indicated as Class I it means that more than two-thirds of the area consists of Class I farms. Class II areas include farms more than two-thirds of which are in Class II and so on. Thus the nature of the individual farms is obscured, but the overall pattern of agriculture on the watershed shows up very clearly. The pattern shows a general correlation with the map of physiography. The Glenelg Gravelly Hills show up especially clearly, with a large proportion of abandoned and Class IV farms.

It should be pointed out the classification outlined above is only applicable on the watershed. No comparison was made with any outside area.

FARMS

DISTRIBUTION ACCORDING TO CLASS
ON BASIS OF BUILDINGS AND LAYOUT



SCALE - MILES





*A first-class farm on
a whaleback hill in
Bentinck Township.*



*A first-class farm in
Glenelg Township.*



*A good farm in
Glenelg Township*

Few farms on the watershed are completely abandoned. The land in most cases has been taken up either by lease or purchase by neighbouring farmers who in most cases cultivate a small section and pasture the rest. Farms on which a homestead had been constructed and a start made in farming but which no longer support a family were considered abandoned. In many cases fine brick houses and large substantial barns are found on areas of poor soil such as the Glenelg Gravelly Hills. Sometimes they are abandoned and sometimes they are still occupied and fall into various farm classes. It is difficult to see how farming operations on these soils could have yielded sufficient profits for such construction, for the farms are obviously not in a state of efficient production today.

The farm size and farm classification maps indicate that large areas of the watershed are submarginal from an agricultural point of view. It is evident that a good deal of land requires special management, either as woodland or pasture.

4. AGRICULTURAL REGIONS

As a result of studies made in the course of the survey, it is possible to distinguish several agricultural regions in the area surveyed in 1951. These regions are by no means clearly defined from one another, nor do they include the whole area of the watershed, but nevertheless the pattern of occupancy and the present condition and use of the land are such that they do show some differences. They are herein described.

(1) THE HANOVER REGION

This region is centred on the Hanover Sandy Plain, with its sandy and gravelly soils. This region has the lowest altitudes of any in the watershed. The light soils are warm and easily cultivated, allowing the farmer to grow a cash crop of wheat and some ensilage corn. The farms in this region are small to medium-sized and fall mainly into Class I and Class III, with some cases of abandonment. There is a high percentage of cultivated land, with only a small acreage devoted to forest and pasture.

Since the soils of this region are light, they deteriorate rapidly unless properly managed. Some adjustment to capability is required here. A change from intensive cropping to grassland management would greatly benefit some of the more seriously depleted soils of the region.

(2) THE NORTH BENTINCK AND GLENELG REGION

This region takes in most of the area covered by the Bentinck Whaleback Hills. The main soil type is the Harriston loam, which is characteristic of the drumlins. The farms are again small to medium in size, but fall mainly into Class II and III, although Class I farms do occur.

Adjustment to capability is fairly complete in this region. The drumlins are intensely cultivated where they are not too steep and the steeper slopes and the interdrumlin swamps are left in forest and pasture. Erosion control measures should increase and sustain high yields in this region.

A farm in Glenelg which lacks some mechanical advantages but is kept in fair condition.



This farm in Holland Township has a fair barn and a tractor but is otherwise not as advanced as the better farms on the watershed.

Abandoned farmstead on rocky, hilly land.



(3) THE EDGE HILL REGION

This region is the most clearly defined on the watershed, since it is a small till plain surrounded on all sides by rougher land. The soils are again Harriston loams and are intensively cultivated. Farms are small to medium in size and are nearly all Class I. Only simple conservation measures combined with ordinary good farming practices are required to sustain a high level of production in this area.

(4) THE FARDEN LAKE REGION

The predominant soil in this region is of the Pike Lake loam. The region is marked by large farms and an extremely high percentage of abandoned farms. Most of those still operating are third or fourth class. Forest and poor pasture is the predominant land use. Since much of the land in this region is of extremely low capability, it should be acquired by the Authority for the establishment of forest cover or permanent pasture.

(5) THE MARKDALE REGION

This region is situated mainly to the east and south of Markdale on the Markdale Rolling Plain. The soil is loamy, but contains more stones and boulders than is usual on a till plain, which tends to limit cultivation slightly. The farms fall either into the small or the large sizes, but all classes of farms are in evidence. The area is mainly cultivated, with only small acreages of forest and pasture.

(6) THE DUNDALK REGION

The predominant soil type of this region is the imperfectly drained Listowel silt loam. The farms are medium and small-sized and are mainly Class II and Class III, with some cases of abandonment. The region is mainly cultivated, with only the poorly drained areas remaining in forest, along with small farm woodlots. Tile underdrainage and grassland management is needed in this region to bring the soils up to full productivity.

5. CONCLUSION

By comparing farm size and farm class with the physiography and land use, it is apparent that a number of factors seriously limit agricultural use. These factors are boulderiness, steep slopes and susceptibility to erosion, light-textured soils and poor drainage. From the regional analysis it is apparent that the good and fair soils carry most of the agricultural production. Conservation calls for the exclusion of agriculture from soils not suited for it and the management of the better soils in a way which will sustain their fertility.

While the regions described above are not all inclusive, they should be taken into account when conservation practices are being put into effect. They will provide a guide to the overall program of soil conservation on the watershed.

CHAPTER 9

RECOMMENDED LAND USE

1. BASIS OF RECOMMENDATION

The proven capability of the soils is the basis of the recommended land use. Further consideration is given to the present use and the extent of the changes

which would have to be made. Once the capability is established, recommendations are made for the special management of certain soils to conform to known principles of soil and water conservation.

The recommended land use for the watershed is shown on the folded map which accompanies the full report.* This map sums up what is known about the soils of the watershed and provides a guide to future land use. A pattern of land use and management conforming to that of the map should conserve soil and water and make the land serve the whole community to the greatest advantage.

2. RECOMMENDED LAND USE

Six classes of recommended use account for all of the soil types and conditions. They are:

(a) L—UNRESTRICTED USE

Cultivable land with no restrictions in use, requiring no special management beyond good farming practices, good tillage, fertility maintenance, weed eradication and use of good seed.

Included in this recommended class are the level and uneroded loams and sandy loams. Regular four- or five-year crop rotations with application of manure and use of artificial fertilizer when necessary should be sufficient to keep these soils in a productive state.

Areas of this class of land are coloured light yellow on the map. That there are no special problems concerning this land does not mean that it is of no concern to the conservationist. It must always be borne in mind that it is only through the best use of the good land that the poorer land will be relieved of the burden which depreciates it.

(b) CF—CONSERVATION FARMING

Cultivable land which requires some special practices to control erosion.

This recommended use class, indicated in buff on the map, is land of lower capability which is susceptible to erosion and water loss. It includes the gentler slopes on the Bentinck Whaleback Hills and the Durham, Markdale and Dundalk Plains. The special practices recommended on this type of land are contour tillage, strip-cropping, diversion terraces and grassed waterways, described in the chapter outlining conservation practices.

(c) LR—RESTRICTED USE

Cultivable land of lower capability or susceptible to erosion which should be protected by extended crop rotations or which requires intensive soil-building practices (manure, mulch, green manure, etc.).

*Copies of this map are available on request from the Conservation Branch, Department of Planning and Development.

This is land of lower capability. The soils require building up and can never be expected to give yields consistently as high as those in the previous two recommended classes. These soils should be protected by the use of extended rotations whereby the land is broken up only once in five years, one crop of grain or intertilled crops grown and then re-seeded to grass or legumes again. Every possible method of rebuilding organic content should be followed, including winter cover crops, green manure, and dressing of stable manure.

This class includes sloping and eroded soils of the Holland Ridge which do not lend themselves to mechanical erosion control and the light-textured soils of the Hanover Sandy Plain and the Glenelg Gravelly Hills. The latter soils tend to dry out and the organic content is soon "burned" out of them.

(d) LD—DRAINABLE LAND

Cultivable land which requires artificial drainage to bring production up to its capacity to produce.

This recommended use type occurs on soils whose capability is lowered by imperfect internal drainage, resulting in late planting and shallow-rooted crops. The capability of these soils may be improved by the installation of tile drains and by the maintenance of a high organic content.

The largest acreage of this type occurs on the Dundalk Silty Plain, with smaller areas in the Bentinck Whaleback Hills. The latter areas can usually be drained with very simple methods of tiling and a low capital outlay. The Dundalk Silty Plain, however, requires much more intensive measures, including the construction of municipal ditches. The soils here are practically all silt loams and may require heavy tiling before they can be properly drained. It is recommended that an experimental drainage area be instituted before any general drainage scheme is undertaken, in order to assess the value of benefits derived.

(e) P—PASTURE

Land unsuitable for cultivation which should be protected from erosion and water loss by the establishment of good sod cover.

This recommended use is indicated on the rougher land of the Holland Ridge and the Glenelg Gravelly Hills which cannot be cultivated economically and which is susceptible to erosion and water loss, and on the steeper flanks of the Bentinck Whaleback Hills. These soils should be protected by seeding to permanent improved pasture. Much of the cleared land in this class is already in use as pasture, but in most cases the quality has deteriorated to a point where it will support only a relatively small number of animals. These areas also suffer from summer drought, indicating a low organic content in the soil. The establishment of a rich, nutritious pasture will be reflected in the production of beef and milk, besides being one of the best conservation practices which can be instituted on the watershed.

(f) F—WOODLAND

Land of low inherent capability or having excessively steep slopes which should be retained under forest cover or planted with trees.

RECOMMENDED LAND USE
(ACRES)

Township	Unrestricted Use L	Drainable Land LD	Restrictions on Use LR	Conservation Farming CF	Pasture P	Woodland F	Lakes	Urban	Total
Glenelg.....	3,089	501	10,583	8,617	8,639	36,948	274	361	69,012
Bentinck.....	3,380	361	18,136	8,427	6,740	24,531	390	279	62,244
Artemesia.....	3,982	2,542	10,239	3,295	2,712	14,983	127	165	38,045
Brant.....	324	.....	804	.....	44	857	155	144	2,328
Proton.....	2,903	3,991	2,084	6,342	262	9,488	16	23	25,109
Holland.....	250	.....	3,976	1,155	2,026	6,568	112	41	14,128
Sullivan.....	.....	.....	777	321	412	2,387	46	.....	3,943
Euphrasia.....	429	.....	2,489	312	822	3,999	29	.....	8,080
Osprey.....	2,085	1,237	798	2,108	184	5,003	.....	.....	11,415
Melancthon.....	678	608	.....	448	.....	940	.....	.....	2,674
Normanby.....	68	.....	1,307	657	534	1,811	.....	.....	4,377
Egremont.....	71	28..	2,655	199	2,274	4,924	101	.....	10,252
Total.....	17,259	9,268	53,848	31,881	24,649	112,439	1,250	1,013	251,607
Percentage.....	6.6	3.6	21	12.3	9.7	44.6	.5		

Extensive areas of soils of proven low capability have been designated throughout the watershed for acquisition by the Authority, in order to establish an Authority Forest. These areas are discussed in detail in the Forestry Section of this report. These areas are included, in the main, in the areas designated for reforestation on the map of Recommended Land Use. On this map, however, property boundaries were not taken into account.

Where there are small woodlots and small areas of idle land or poor pasture on the poorest soils, they have been recommended for woodland also. Establishing and maintaining these are, however, a matter for owners and proprietors of land. In some cases, they are adjacent to the bigger blocks recommended for acquisition by the Authority.

It should be understood that existing woodlots on better classes of soils or apart from the areas recommended for woodland should be retained as far as possible. When woodlots are cleared out completely, equal areas of trees should be established on available land of low capability.

3. CARRYING OUT A SOIL CONSERVATION PROGRAM

Soil conservation falls naturally under three headings—forestry, grassland and farm planning. Good forestry is just as essential in private woodlots as in publicly owned lands. A well managed woodlot provides a source of income and a source of timber and firewood for the farm. Indirect advantages are derived from windbreaks, shady protection of stream sources and habitat for wildlife.

The main features of woodlot management are the exclusion of cattle to allow thick undergrowth and young trees, and cutting of mature, overmature and dead trees. Advice and assistance in matters of woodland management can be obtained from the Zone Forester, Department of Lands and Forests, Owen Sound, Ontario.

The importance of grassland in checking erosion, conserving soil moisture and building soil has already been discussed. Advice on pasture management can be obtained from the County Agricultural Representative at Markdale.

Farm planning means the adoption of a number of special practices especially designed to control soil erosion and water loss and the adjustment of the tillage methods and cropping systems to the capabilities and natural features of the land. The Department of Agriculture has established a division of the Soils Department of the Agricultural College to advise farmers in these methods. This is called the Farm Planning Service. This service is available to the individual farmer who wishes to change his methods of tillage and cropping to conservation farming, by application to the Agricultural Representative.

The establishment of a conservation program depends in the first instance on leadership by the Authority for the individual landowners. Certain large measures such as reforestation and engineering work must, of course, be carried out by the Authority. However, most of the land remains in private hands, and it is the responsibility of the individual farmers to carry out whatever changes in land use are necessary to ensure soil conservation. The function of the Authority is to demonstrate and teach, and to organize and engage in experimentation where necessary.



*Alternate strips of grain and clover running across the slope prevent erosion,
allow rain water to soak into the ground.*

In the second instance, the conservation program requires co-operation between individuals. When the land was opened up by pioneers, a great deal was done by community effort which could not be done by individuals alone. Logging bees, barn raising and threshing bees were essentially community projects. This community spirit is not lost, although the modern mechanized farm is more independent. Many of the measures designed to conserve soil and water can be most economically carried out by community effort.

The community spirit in conservation is best exemplified by co-operation among the inhabitants of a small river valley within the larger watershed. By community effort the costs of establishing a conservation program can be materially reduced. Besides the individual efforts of building grassed waterways, gully control, improved pasture, woodland management, and building farm ponds, the stream itself may be improved by co-operation of the individual farmers. This includes cleaning out the stream bed, planting trees along the banks and fencing the stream from cattle. A complete plan for a small river valley is set out in a booklet entitled the Avon Valley Plan, which is available from the Upper Thames River Conservation Authority.

The most important step in soil improvement and conservation on the watershed as a whole is pasture improvement. The Authority might aid in this matter by the acquisition of land, probably adjacent to an Authority Forest, to be improved and held under sod. Grazing could then be let out to nearby farmers who need extra summer pasture, thus making the project self-supporting. The project would serve two purposes, actual conservation of the soil on the fields so managed and a demonstration of good pasture management on similar areas.

In the field of farm planning, the setting up of a demonstration on a farm by co-operation of a farmer has proven to be the best method of advancing ideas in a farm community either for a complete farm plan or for showing individual remedies, e.g., improved pasture. This is, however, not so urgent a matter on the Saugeen Watershed, due to the relatively small acreage of land suitable for contour cultivation. A partial demonstration farm might be set up showing the benefits of extended rotations, terraces and winter cover crops.

4. EDUCATION AND PUBLICITY

It is in the promotion of the ideas and aims of conservation that an Authority can take action at any time. The tools are ready at hand—schools, the local press and radio, agricultural institutes and boards, junior farmers' clubs and farm forums. As these are all local organizations the subject can be dealt with in terms of local conditions. In this way, it is brought home more directly than by books or journals with wide circulation. It is intended that information given in the Land Use Section of the report be helpful in discussion and teaching on a local and regional basis.

5. CONCLUSION

The map of Recommended Land Use which accompanies the full report is an interpretation of the soil resources of the watershed in terms of future use. It is recommended to the Authority and to all those concerned with the welfare of the land as a guide to a land use policy which would conserve the soil resources of the watershed.

3

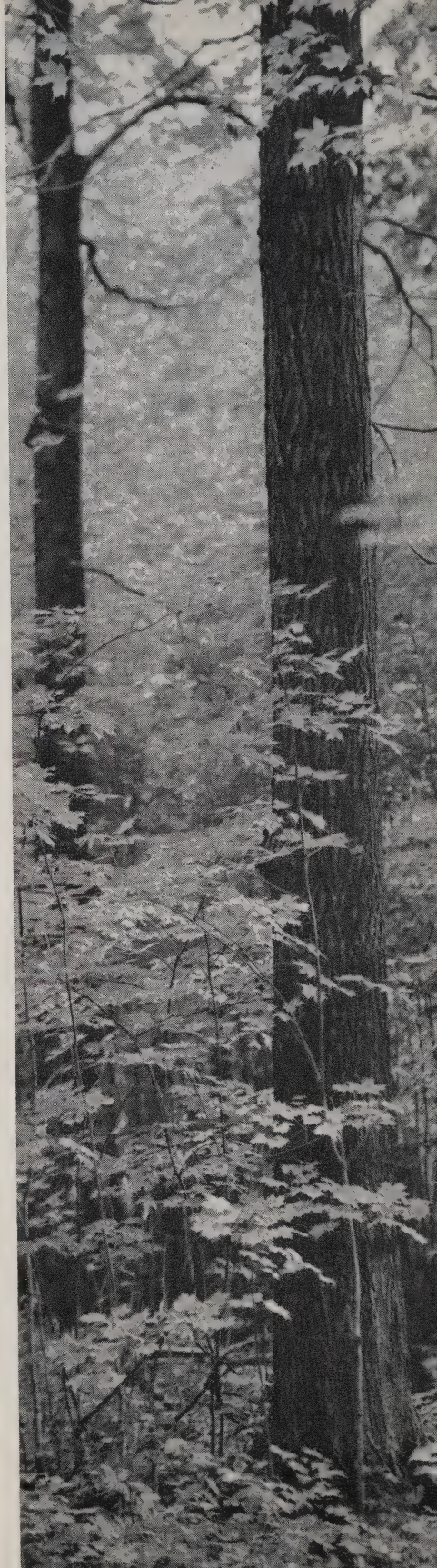
FOREST

CHAPTER 1

THE FOREST

Good early descriptions of the forests of Southern Ontario are rare and none have come to light covering the forests of the Saugeen Watershed. Some information, however, may be gleaned from the records of the first surveyors, who were instructed to enter in their note-books "each kind of timber in the order of its relative abundance".

The most striking feature of the Upper Saugeen from the forestry point of view is the almost complete absence of pine in the original forest, and as one drives over the watershed today the lack of stump fences is very noticeable. The only area of pine seems to have been in the vicinity of Durham. Rankin noted the north end of this stand in 1837 and it probably extended south-east to Wilder Lake.



The forest was primarily a sugar maple forest over most of the dry land, while the swamps produced an unusual quantity of cedar which helped to compensate for the shortage of pine.

Although settlement did not begin until about 1850 the census records show that in Grey County occupied farm land was 54 per cent cleared by 1870 and 79 per cent cleared by 1900. In 1940 woodland is given as about 17 per cent of occupied farm land.

The actual measurement of woodland in the Upper Saugeen Watershed made in 1951 shows a total of 54,705 acres or 21.3 per cent of the watershed area.

CHAPTER 2

FOREST PRODUCTS

Two factors served to make the pattern of lumbering on the Upper Saugeen Watershed somewhat different from that on watersheds further east. First, the timber was predominantly hardwood. Secondly, it had to travel westward down the Saugeen and then eastward through the Great Lakes. Consequently not a great deal was exported to Britain though considerable quantities went to the United States. Also the building of boats for the lakes' trade early became a thriving business and this absorbed a great deal of timber.

Until 1826 the timber on the public lands was reserved for the Royal Navy and could not be cut without licence. There was a considerable illicit trade, but the restrictions were a source of annoyance to the people and authorities of the colony. A system was set up by which anyone was at liberty to cut timber on the ungranted crown lands of the Ottawa region by paying a fixed scale of fees.

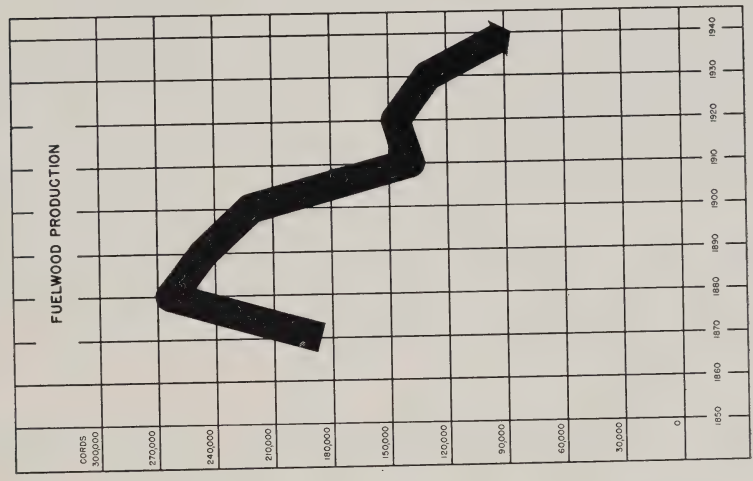
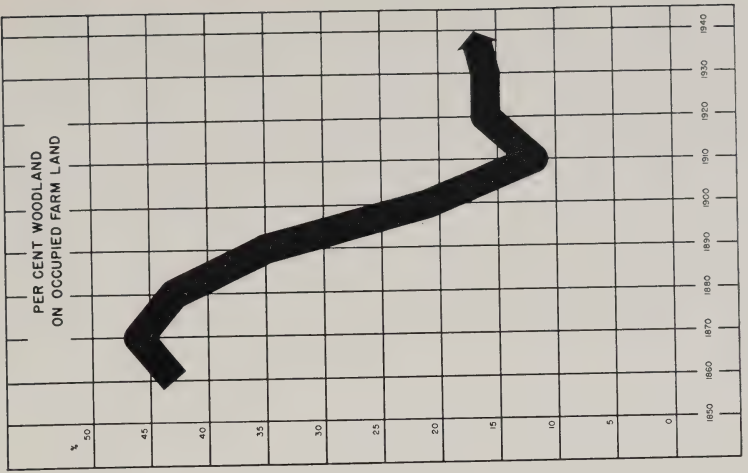
Mast timber was marked by government agents with a broad arrow blaze. As late as 1827 the Surveyor-General was ordered to make a survey of "Masting and other Timber fit for the use of His Majesty's Navy". The mast and spar export to Britain thrived in the 30's and 40's and continued intermittently up to 1855. The British trade dropped off noticeably after the Reciprocity Treaty with the United States in 1854, and after the building of railway connections with United States cities.

Squared timber at first consisted mostly of white pine, squared on all four sides into one long stick. Later walnut, oak, ash, birch, elm, maple and even hemlock were made into squared timber.

In the very early days of settlement sawn lumber was prepared by hand-sawing in a saw-pit or with a platform on which the "top-sawyer" stood while his mate stood below the log. Twenty-five boards was a heavy day's work for two men. The type of saw used for such work was a "whip saw".

A study of the Census of Canada forest products returns reveals the various changes in the lumber industry. From 1870 to 1890 much of the timber was squared and measured in cubic feet. In 1870 other products listed were fire-

GREY COUNTY CENSUS OF CANADA FIGURES



wood, staves, lathwood, tanbark, and masts and spars. Between 1880 and 1890 the peak production of nearly all items was reached and squared elm alone in Grey County ran to over 600,000 cubic feet in 1880. In 1890 fence posts and telephone poles were added to the list of products, as were railway ties. In the census years of 1900 and 1910 square timber was still recorded in cubic feet and logs were measured in board feet; staves, lathwood, masts and spars and tanbark disappeared from production after 1910.

In 1920 no square timber is shown, logs are only counted, not measured, and not even separated by species. The returns of the latest census covering the year 1940 name only one forest product and the rest are all listed together as others valued at so many dollars. The one product which has persisted throughout the records is firewood which in Grey County has dropped from a peak of 268,818 cords in 1880 to 87,553 cords in 1940.

One or two interesting observations with regard to individual species may also be made. Tamarack was listed regularly until 1890, after which it no longer appears due to the depredations of the larch saw-fly which almost wiped it out at this time. The returns show that some black walnut and hickory were cut in 1880. White pine was, of course, the species most sought after, though not much existed in Grey County, and next to it red pine of which a little was present. In 1870, 1880 and 1890 elm was the main species which was squared, but as this species became scarce more ash, birch, and maple were made into square timber.

Wood was the sole source of fuel until 1850. With the introduction of steam power the forests of the area were ruthlessly cut to supply fuel for engines. Steamboats used fifty or sixty cords between Toronto and Montreal. For some time after 1856, the railways burned large quantities of the best body hardwood, chiefly beech and maple.

A great quantity of wood was consumed in building bridges and roads, both the early log "corduroy" roads and the later plank roads. Much cedar and some other wood was used for rail fencing, though pine stumps or stone sometimes took the place of rails. About 1900 wire fencing came into use and a fence-post industry developed.

Woodworking and planing mills were introduced into the watershed in a later stage of settlement. At first all the trim for buildings and the sash, doors and "blinds" (shutters) were made on the job by the carpenter, and even boards were planed by hand. Later, water-driven "planing and turning machines" were introduced and with the increased use of steam power, power planing and turning mills became more common and "sash, door and blind factories" were set up in some places.

Wooden implements and vehicles required special woods for the different types. Hickory was preferred for axe-helves, beech for the beams of ox-yokes and ironwood for the loop or "bow". Spike handles were made of rock elm, white ash, hickory or ironwood. Vehicles were first made by the farmers themselves, later by carriage- and wagon-makers in the villages. A good deal of selected rock elm, white ash, hickory and ironwood was used for this purpose.

Factories finally replaced the single craftsman or small shops in those types of woodworking.

The three most important indirect products were maple sugar, potash and tanbark. Maple sugar was almost the only sugar available to the pioneers but in 1910 the Census records began to list maple syrup as well, indicating the change from a pioneer necessity to a modern luxury. The production of sugar and syrup in Grey County in 1940 was less than 17 per cent of the output in 1860. Potash was extracted from the ashes of hardwood trees (60 large maple trees produced one barrel of 650 pounds) and shipped to Britain for use in the dyeing industry. Tanbark came from oak and hemlock trees and was used in tanning leather.

CHAPTER 3

PRESENT WOODLAND CONDITIONS

In order to get an accurate picture of woodland conditions in the watershed, a detailed study was made of all woodlands, natural water-storage areas and plantable land. Every area of woodland, marsh, swamp or other wasteland was visited and studied. Where doubt existed whether an area should be classified as woodland or not, woodland was given the benefit of the doubt.

All woodlots were grouped according to the classification in which the term hardwood is used for all broad-leaved trees. The group in which a stand is placed is that of at least 80 per cent of the trees. A stand in which neither hardwood nor conifers predominate is classed as a mixed stand. Stands were also grouped according to the degree of maturity, cutting and forest cover type. Records were made of planting, care, damage and survival of all plantations.

There are 54,705 acres of woodland within the watershed or 21.3 per cent of the total area of 256,211 acres. Separate woodlots examined numbered 5,518. In many cases, differences in type and age made it necessary to list large single wooded areas as several woodlots, while other wooded areas, extending over several properties without boundary marks, were sufficiently uniform to be classed as one woodlot.

The conifers occurring in the watershed are white cedar, balsam fir, tamarack, hemlock, white spruce and black spruce. Red pine may have occurred in a few locations in the original forest but no trees from natural seeding were found at the time of the survey. White pine occurs sparsely throughout the swamps of the hilly or undulating areas but is rare in the swamps of the great flats of Proton and Osprey Townships. The species as a tree of the uplands never was common and now has almost disappeared. White cedar is extremely common and is a species of the slopes as well as the swamps. Fir, spruce and tamarack are common as swamp species throughout the area. Hemlock is found mixed with the upland hardwoods and also occurs in the swamps of the hilly or undulating areas.

The hardwoods in the area form a long list and are the common species of the Huron-Ontario Section of the Great Lakes-St. Lawrence Forest Region.



Originally most of the Upper Saugeen Watershed was covered with pure stands of sugar maple. Much of it has been cleared for agriculture, but even today the sugar maple type forms over 25 per cent of the woodland.



Cedar was also very abundant on both dry and wet sites, and this type still constitutes almost another 25 per cent of the remaining woodland.

White pine was always scarce in the Upper Saugeen Watershed, the only stand of any extent being that north of Durham mentioned by Rankin in 1837, which may have extended to Wilder Lake where a few trees may still be seen.



Cattle have destroyed all reproduction and most of the forest duff in this woodlot. This, combined with compaction of the soil, is beginning to kill the large trees.



Fire is only a serious menace in cedar swamps, but here it can do great damage. With the increase in the area of plantations of softwood trees the risk is constantly increasing and a small but efficient fire protective system should be established.



However, the occurrence of oak, particularly red oak which may be expected to occur, is rare, and only a few red and bur oak trees were noted by the fieldmen. Sugar maple, white elm, basswood, beech, white ash and black cherry dominate the uplands or better drained areas, while black ash, white elm, balsam poplar, trembling aspen, yellow and paper birch, and silver and red maple are typically the hardwoods of the swamps.

The survey classed the present woodland as:

hardwoods—28,927 acres or 52.8% of the total;
 mixed woods—16,213 acres or 29.7% of the total;
 coniferous woods—9,565 acres or 17.5% of the total.

The composition of each of these classifications by diameter ranges at breast height is shown.

Diameter Ranges (inches)	Hardwoods		Mixed Woods		Coniferous Woods	
	Acres	%	Acres	%	Acres	%
Over 18.....	401	1.4	5	0.0	.....	.....
10-18.....	8,467	29.3	1,141	7.0	116	1.2
4-10.....	15,977	55.2	13,914	85.9	8,424	88.1
Under 4.....	4,082	14.1	1,153	7.1	1,025	10.7
All.....	28,927	100	16,213	100	9,565	100

For the whole area the percentage of uneven-aged stands is somewhat more than the even-aged, the figures being 58 per cent of the former and 42 per cent of the latter.

Grazing in farm woodlots is still fairly general, the percentage of grazed woodland being 43 per cent for the whole watershed. The percentage of grazed woodlots is low as compared with other watersheds.

In this report woodlands are areas supporting species which may reach merchantable size and so have a market value. In contrast to such areas are scrublands. These support woody shrub growth the species of which never reach true or commercial size and have no presently recognized market worth. These areas are recognized in two broad categories—areas of poor drainage, termed wet scrub; and better drained areas, termed dry scrub. Locally these areas are commonly called wasteland or slash land when they are dense or wet enough to interfere seriously with pasture. Some can be restored for pasture by special practices such as draining. These should be returned to woodland on private land. The decision must rest with the owner as to whether or not he is prepared to do the work necessary to clear the land and maintain permanent pasture. If not, tree cover should be restored.

The extent of wet scrub in the area surveyed is 5,564 acres or 2.2 per cent of the total area. The growth common to these areas of poor drainage is shrubby willow, dogwood, alder and other woody shrubs which can tolerate very wet sites. Often small clumps of such tree species as poplar, elm, tamarack, black ash and others are associated with the scrub species.



This woodlot was cut subsequently to the passing of the by-law. Some fair-sized trees remain and young growth is filling in the stand.



This area was clear-cut before the diameter limit by-law was passed in Grey County and a dense cover of weeds has grown up.

The jack pine sawfly is defoliating and killing these trees. Spraying would stop the infestation.



Such areas bear a relation to commercial forest growth in that in many cases they once supported merchantable tree growth. Where the restoration of these areas to commercial forest growth is desired and seems possible in the light of facts known, such should be encouraged by the exclusion of cattle from the area. However, it is known that some of these areas have always had a history of wet scrub growth, and for these areas considerable research is needed into the problems of preparation of the site for commercial growth and the long-term economics of such a project.

Dry scrub covers 1,905 acres or 0.7 per cent of the total area. The growth consists of hawthorn and sumach, usually on run-down pasture. If the land is not worth restoring to permanent pasture, trees will be the most profitable crop which may be raised and will smother out the scrub growth in time.

CHAPTER 4

CONSERVATION MEASURES IN PROGRESS

Forest conservation work in Southern Ontario is carried out under the direction of the Zone Foresters of the Department of Lands and Forests. The office serving the County of Grey is located in Owen Sound and a good deal of reforestation, both private and county, has already been done in the Saugeen Watershed under the supervision of the forester there. This watershed, however, embraces a considerable area of land only suitable for the growing of trees and much remains to be planted.

The nearest forest tree nursery to the Saugeen Watershed is that at Midhurst in Simcoe County, which was established in 1922 and has served as a production and distribution centre for trees ever since. Today, thirty years later, the Midhurst Provincial Forest Station presents a magnificent young forest of pines and other species. Thousands of visitors go to this beauty spot and a small park is provided for their accommodation. Many officials of municipal and other organizations from all parts of the Province have visited this station and returned convinced that all the waste areas of the Province should be reforested and so made useful and beautiful.

1. PRIVATE PLANTING

Reforestation, combined with the protection of natural woodlots, is essential if farmers are to have sufficient woodland to supply the local community with fuelwood, fence posts and poles, and to have a few saw-logs for sale which will provide a cash crop at times when the prices of other farm products are depressed. Reforestation of certain areas will not only mean that the land will be producing a crop where little or nothing of value is growing now, but it will also provide adequate protection for the soil and will retard run-off of water from melting snow and rain, thus making for a more even stream flow throughout the year. In addition to this, the greatest advantage will be that it will retain the many wood-using industries within the watershed, where the employment they provide will benefit all the members of the river valley community.

To aid in reforesting marginal lands the Authority is renting a tree-planter at nominal cost to landowners. This machine will plant up to 10,000 trees per day.



Where seed trees are present, white cedar will often reforest an area naturally if cattle and fire are excluded.

In some locations hardwoods too will reforest the land, particularly on the lee side of existing woodlots.



In 1906 a statute was passed in Ontario which permitted a township council to exempt a part of the woodland of a farm from taxation; it provided that exemption be extended to any part of a farm used for forestry purposes as being "Woodlands", as defined by the Act; provided that such exemption shall not be greater than one acre in ten acres of such farm and not more than twenty acres held under a single ownership.

In 1927 the exemption of taxation on woodland was made compulsory if applied for, and is interpreted as meaning planted as well as natural trees.

In 1938 The Assessment Act was amended to prevent the assessment being raised on land after it had been reforested.

Both these Acts were designed to encourage the planting of trees on private land and should be taken advantage of by citizens anxious to improve woodland conditions on their own property and at the same time benefit the whole community of the river valley.

Within the Upper Saugeen Watershed there are 348 private plantations, most of which are small, namely two to twenty acres in area. The most extensive are in Holland and Bentinck Townships though the oldest are near Wilder Lake in Egremont.

More and more land is being reforested by private owners each year and the Authority maintains a tree-planting machine which it rents at a nominal sum for this purpose. The Provincial Government makes a charge of \$15 per thousand for Scotch Pine and \$10 per thousand for all other species.

2. COUNTY FORESTS

The present policy of County Forests was laid down in 1922, and is carried on under The Trees Act (R.S.O. 1950, c. 399). Under this Act a municipality may purchase land for reforestation and enter into agreements for its management without any limit as to size. The agreements now in force run for thirty years, the Ontario Government agreeing to establish the forest and pay all the cost of management during that time.

Under the Act, townships have the same powers as counties, excepting that of issuing debentures. They may levy, by special rate, a sum not exceeding \$1,000 in any year, for reforestation purposes.

Grey County has a forest of over 4,200 acres in a number of tracts throughout the county; 2,037 acres lie within the Upper Saugeen Watershed, including the Main Tract in Glenelg Township which comprises 735 acres. This forest is being constantly added to, the open land reforested and the existing woodlands managed under the direction of the Zone Forester.

3. AUTHORITY FORESTS

The agreements which have been drawn up between the Ausable, Ganaraska, Grand, Humber, Moira, Saugeen and Thames Authorities and the Ontario Government to establish and manage the Authority forests are substantially the same as those made with the counties, except that the Government has agreed to pay half the cost of the land and the agreement for planting and

management is to run for approximately fifty years. County-owned lands are tax-free but Authority-owned lands are not; consequently many townships prefer the Authority type of agreement.

4. MUNICIPAL FORESTS

Municipal forests are owned and managed by municipalities other than counties.

There are two plantations which may be considered municipal plantations, one near Durham and the other just outside the Upper Saugeen Watershed near Hanover. Between 1933 and 1946 the Town of Durham planted some 15,000 trees, mostly along the banks of the Saugeen River. During the period from 1927 to 1936 the Town of Hanover planted the area from which it derives its water supply with trees and now has a fine municipal forest of about 85 acres.

Assistance with regard to the establishment of municipal forests and the supplying of free trees is still the policy of the Department of Lands and Forests. Moreover, as provided by The Trees Act (R.S.O. 1950, c. 399), it is possible for a township council to enter into an agreement with private landowners for the reforestation of their property. The agreement will prescribe the cutting conditions of all trees planted and such conditions will be subject to the approval of the Minister of Lands and Forests.

The Trees Act also makes provision for exempting such lands from taxation and for making arrangements with the Dominion and Provincial Ministers of Labour regarding conditions of labour and payment of wages in connection with planting and conservation of such areas.

5. DEMONSTRATION PLANTATIONS

In 1922 the Provincial Government began the policy of assisting municipalities in the establishment of small forest plantations for the purpose of demonstrating the use of trees on marginal and submarginal land. To meet the requirements for such a plot the Government required that the area be on a well-travelled road so that as many people as possible could see it; that the municipality either purchase land or use land which was in its possession, fence it, and agree to give the area reasonable protection after planting. In return the Government agreed to supply the trees and pay the cost of planting and of supervising the work when the planting was in progress. In 1932, when Government funds were curtailed, the policy governing these demonstration plots was changed, and from that time to the present the Government has not paid the cost of planting, although the other conditions governing the establishing of these plots have remained the same. The Hanover waterworks forest was originally set out as a demonstration plantation in 1927.

The value of such plots, if well cared for, in showing landowners what can be accomplished in a very few years by planting trees is so great that every township should endeavour to establish at least one plot.

6. DEMONSTRATION WOODLOTS

Demonstration woodlots are privately owned areas of woodland on which the owners have agreed to follow prescribed methods of woodlot management,



outlined by the Department of Lands and Forests, under the Zone Forester, and to permit access to the area by interested persons. Such demonstration woodlots and the influence they exert for the proper management of similar areas contribute to the total conservation effort in any watershed.

Six demonstration woodlots have been established in the Upper Saugeen Watershed.

7. SCHOOL FORESTS

In order to encourage the establishment of school forests planted and cared for by school children, the Ontario Horticultural Association in 1945 organized an annual competition. Prizes are offered for the school having the best plantation and knowledge of forestry in each forest district in Southern Ontario and for the district winners to meet in a provincial competition. Prizes for these competitions are generously provided by the Ontario Conservation Association and by private donors.

Many schools in the area have entered these contests in the past and several schools have taken prizes in the district competitions.

Trees have also been sent out to schools in the watershed and have been distributed to children for planting on the home farm, and many of these have been used to form shelterbelts and windbreaks.

8. 4-H CLUBS

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests and must be sponsored by an organization interested in the improvement of woodland and reforestation.

Members must be between 12 and 21 years of age and each member undertakes a project such as marking a half-acre plot of woodland for thinning or reforesting a quarter-acre of land. Projects are judged annually on Achievement Day and prizes awarded; for this purpose the Department of Agriculture furnishes \$3.00 per member and the sponsoring organization \$1.50. Winners may enter the Provincial Inter-Forestry Club Competition.

9. FINANCIAL RETURNS FROM REFORESTATION*

In addition to indirect benefits such as ground-water supplies, amelioration of floods, wildlife protection and other influences, reforestation has definite financial returns. In support of this the following data are submitted, based on studies of reforestation areas in Southern Ontario, some of which are 40 years

*Report of the Select Committee on Conservation, 1950, Chapter 31.

FOREST PLANTATIONS

← The Saugeen Watershed contains many thousands of acres where trees are the crop which will yield the highest financial returns. At 30 years of age a red pine plantation such as this should yield in thinnings alone 10 cords of wood per acre at a profit of \$3 per cord or \$30 per acre. At 60 years it should have returned to the owner in thinnings, poles and saw logs a net profit of \$445 per acre. Grey County has realized this for some years in establishing County Forest Tracts. The Saugeen Authority is building up the Authority Forest, and private owners are reforesting their marginal land. The Authority rents tree-planting machines at a nominal charge, and the Zone Forester furnishes advice on planting and management.

of age. Red pine is used as an example because it thrives on sandy soils, has few serious insect and disease enemies, and has splendid marketing possibilities during the early years of rotation in the form of poles and pulpwood. The data here given are based on an area of at least 1,000 acres, which allows for sufficient spread for supervision. Furthermore, it should be pointed out that over the years there has been a considerable fluctuation in the cost of planting, price of land, and to a lesser degree in the cost of supervision. Land costs have been as low as \$2 or \$3 per acre; planting costs have been considerably less than shown, and can be reduced by the use of more planting machines. The cost of supervision is based on the salary of a resident caretaker on 1,000 acres, although this could be reduced further if the area under supervision were 2,000 or 3,000 acres.

COSTS OF RED PINE—60-YEAR ROTATION

Trees Planted 8 x 8 or 680 Trees per Acre
3% Compound Interest

Item	Amount \$	Total in 60 years \$
Land.....	10.00 per acre	58.91
Planting, including trees...	20.00 per acre	117.82
Management.....	2.00 per acre per year	326.10
Taxes.....	10.00 per acre (land only)	65.00
Total for one acre.....		567.83

RETURNS FROM ONE ACRE OF RED PINE

60-YEAR ROTATION

Trees Planted 8 x 8 or 680 Trees

(All figures based on stumpage values)

- Thinnings of 200 trees at 30 years of age

3,000 bd. ft. at \$20.00.....	\$60.00
10 cords pulpwood at \$3.00.....	30.00
	<hr/>
	\$90.00
- Thinnings of 150 trees between 40 and 55 years of age

5,000 bd. ft. at \$20.00.....	\$100.00
15 cords pulpwood at \$3.00.....	45.00
	<hr/>
	\$145.00
- Allowing for losses from the 680 trees planted, it is estimated that there should be at least 200 dominant trees left for the final crop.

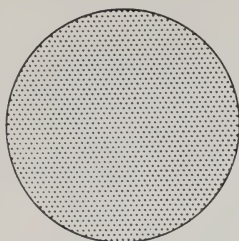
200 15-inch trees for saw timber, 30,000 bd. ft. at \$20.00.....	\$600.00
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Hilly land of this type is best suited for reforestation. Many thousands of acres occur in Glenelg Township.

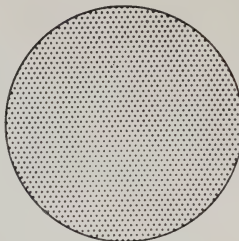
Poorly drained pasture becomes covered with scrub willow. Such areas should be fenced from cattle and planted, where possible.





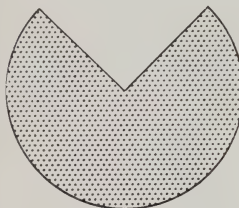
TOTAL AREA

256,211 Acres
100 %



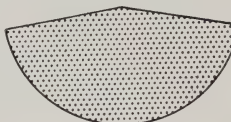
TOTAL AREA

30,028 Acres
100 %



OPEN LAND

192,916 Acres
75.3 %



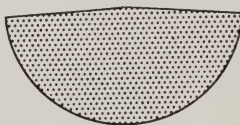
OPEN LAND

13,458 Acres
44.8 %



WOODLAND

54,705 Acres
21.4 %



WOODLAND

14,338 Acres
47.8 %



SCRUBLAND

7,469 Acres (Wet and Dry)
2.9 %



SCRUBLAND

1,592 Acres
5.3 %



WATER

1,121 Acres including 211 Acres of bog
0.4 %



WATER

640 Acres including 211 Acres of bog
2.1 %

TOTAL WATERSHED

RECOMMENDED AUTHORITY
FOREST AREAS

LAND CLASSIFICATION

or

4. 200 15-inch trees as poles, at present Crown stumpage rates.....	\$700.00
5. Previous returns from thinnings could be put back into the operation, or kept separate as a credit at the end of the rotation.	
(1. above) \$ 90.00 for 30 years at 3%.....	\$218.00
(2. above) \$145.00 for 10 years at 3%.....	194.87
	<hr/>
Total per acre.....	\$1,012.87
If poles harvested (4. above) add \$100.00.....	\$1,112.87
Deduct cost of establishment per acre.....	567.83
	<hr/>
Net profit per acre.....	\$ 445.04

CHAPTER 5

FOREST CONSERVATION MEASURES REQUIRED

Probably the most important conservation measure required on the Saugeen Watershed is the establishment of forest areas, to be called the Saugeen Forest, under the Conservation Authority on the marginal lands of the watershed. The table presented in the full report lists 31 such areas and gives their acreages of woodland, willow scrub, water, and open land; the accompanying map shows the location of each of these areas with respect to the landscape types. The names given to these areas are taken from nearby places. The total acreage recommended for acquisition includes natural water-storage areas and reforestation land to the extent of 30,028 acres of which 14,338 have some form of tree cover, 1,592 are willow scrub or hawthorn, 13,458 are open land and 640 acres are water contained in small lakes or bogs.

Scrub land has been placed in two categories: dry-sited scrub which includes such species as hawthorn, apple, and sumach; and wet-sited scrub—willow, dogwood and alder.

Frequently scrub areas of these two types are only suitable for trees. They should be reforested and the acquisition of some of them by the Authority has been recommended.

Controlled woodlot management of privately owned woodlots must be established in some form before conservation measures can be co-ordinated outside the area of the proposed Upper Saugeen Forest. The average owner does not take a wide view of the value of forest cover for protecting stream flow. As a result the systematic cutting, both for lumber and firewood, which has been going on for many years, has done a great deal of damage. The system of selling blocks of timber for fuelwood is another vicious practice, since it almost always leads to complete clean-cutting. This situation should be corrected and areas connected in any way with the headwaters of streams should be controlled so that they cannot be clean-cut.

Provision is now made in the statutes of the Province under The Trees Act which permits a county to pass a by-law regulating the cutting of trees on private land. Twenty counties in Ontario have passed such by-laws, including the five covering the Saugeen Watershed.

One of the most progressive forestry steps taken in Southern Ontario recently was taken by the County of Halton in 1948, when the County Council passed a by-law to aid farmers in fencing their woodlots from livestock.

The by-law states that the County of Halton will grant a sum equal to the prevailing cost price of 8-strand fence wire with a single barb (not the cost of posts or labour) to a woodlot owner who will erect such a fence on one or more sides of his woodlot in order to completely enclose the woodlot, thus fostering forest growth by keeping livestock out. The woodlot must be of a size not less than two acres and livestock must be excluded for a minimum period of ten years.

Such action is of infinitely more value than the planting of many trees artificially. It is recommended that the Saugeen Authority adopt a similar scheme.

Though fire protection is a serious question in the Saugeen Watershed only in certain areas such as large swamps, it is one to which some attention should be given at once, particularly in view of the extensive coniferous plantations which are being established.

CHAPTER 6

FOREST INSECTS AND DISEASES

In any project, such as that proposed for the watershed, careful consideration should be given to the prevention of insect outbreaks and tree diseases, and arrangements made for control measures when necessary. There are a number of fundamental principles which will greatly lessen the destructiveness of these pests, which are set forth in the full report.

CHAPTER 7

LAND ACQUISITION

The problem of land acquisition should be approached carefully. It is not the practice in Ontario to overrule personal rights of ownership under the principle of eminent domain except to carry out works urgently required for the general good. The acquiring of poor land in the Upper Saugeen Watershed for reforestation may certainly be placed in this class and requires a more permanent authority than the individual to return it to its proper use. However, the problem should not be approached in a dictatorial manner and the willing co-operation of the people of the area should be secured by full explanation of the scheme and demonstration of its future benefits to the community.

The only part of the watershed where large-scale transfers from private ownership to the Authority would have to be made are those areas which are recommended as reforestation land. The best farms in these areas need not be

AREAS RECOMMENDED FOR AUTHORITY FOREST

SHOWN IN GREEN



entirely withdrawn from agriculture, where upkeep of public utilities is not too heavy. They could be incorporated in the forest as farmland and used by forest workers, since both farming and forest work are seasonal to some extent.

There are several methods of acquiring land for conservation purposes. It may be transferred to the Authority by ordinary private sale, a maximum price per acre beyond which the Authority is prohibited to go might be set, or in some cases long-term agreements could be made with the owners for control of such parts of their lands as fall within the forest scheme. As a last resort, the Authority has the power to expropriate land for conservation purposes under The Conservation Authorities Act.

COST TABLE—COUNTY FOREST AREAS—UPPER SAUGEEN WATERSHED

Tract Name	Township	Year Purchased	Acres	Cost per Acre \$
Riddell.....	Bentinck	1948	100	7.00
Crawford.....	Bentinck	1949	102	7.35
Main.....	Egremont	1938	66	21.80
Main.....	Glenelg	1938 1944 1947	674	5.89 ^a
Markdale.....	Glenelg	1938	400	4.37 ^b
Kenny.....	Glenelg	1946 1949 1951	400	3.77 ^c
Glenrodin.....	Glenelg	1946 1951	200	3.50 ^c
Dunsmore.....	Glenelg	1947	100	7.00
Average cost per acre for 1,987 ^d acres of the total of 2,042 acres.....				6.00

a—Includes 200 acres purchased from the office of the Commissioner of Agricultural Loans, Ottawa, at \$3.50 per acre.
b—Includes 200 acres purchased from the Crown at \$4.00 per acre.
c—Includes 100 acres purchased from the Crown at \$1.00 per acre.
d—Includes 400 acres of low cost land purchased from the Crown but not 55 acres, for which figures were not obtainable.

CHAPTER 8

SNOW FENCES

The Saugeen Watershed lies in the Ontario “Snow Belt” and much of it is level land with little tree cover, exposed to strong winds which cause a great deal of drifting snow in winter. Much of the cost of controlling drifting can be eliminated by substituting permanent hedges of trees in place of snow fences. In addition to preventing drifting, snow hedges furnish many of the conservation benefits of windbreaks but on a reduced scale because of their lower height. Every encouragement should be given to their establishment.

CHAPTER 9

WINDBREAKS

In the process of clearing land for agriculture, woodlots and belts of trees along fence lines have been removed which served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program.

CHAPTER 10

THE HARVESTING, MANUFACTURING AND MARKETING OF THE WOODLAND PRODUCT

1. THE TIMBER HARVEST

The harvesting of woodland products is carried on by sawmills whose log consumption is great enough to employ a permanent logging crew; by sawmills whose mill personnel also do the bush work; by sawmills who contract their logging; by loggers who make a business of buying standing timber and selling the logs; and by farmers who sell their logs at the roadside. The logging operation is composed of four separate and distinct phases. These are cruising, cutting, skidding, and loading and hauling.

(a) CRUISING

Cruising is the estimation of timber quantity and quality. Only one operator on the watershed is at present using a percentage sample to estimate standing timber value, but he has found it to be well worth while—particularly when he is bidding for a woodlot in competition with other buyers. The method used by all other operators visited is that of ocular estimation, that is, arriving at a volume figure by walking through the bush and estimating, on the basis of past experience, the number of board feet in the stand.

It is generally recognized by the log buyers on the Saugeen Watershed that bidding for timber has become highly competitive in the last few years and will likely continue to be so. It would appear to be to their advantage therefore to consider the merits of the tallied cruise which would enable them to estimate and bid more accurately on woodland in which they are interested.

(b) CUTTING

Felling and bucking is done by two basic methods—with the crosscut saw and with the gasoline-powered chain saw.

Under optimum conditions an experienced two-man crosscut crew can make up to 4,000 board feet of logs per day, but the average daily output is closer to 3,000 board feet. The daily production per crew is almost trebled with the chain saw (10,000 board feet per day is not uncommon), and cutters are paid from \$4.50 to \$10 per thousand board feet, with the average being close to \$6. Though heavy work, cutting pays well and an experienced two-man crew with a chain saw can make up to \$60 per day.



*Professional power saw loggers can make up to 10,000 board feet of hardwood logs (Doyle Rule) per day.
The high cost of the power saw is beyond the majority of farmers.*

Experienced cross-cut felling gangs can make about 4,000 board feet of hardwood logs (Doyle Rule) per day.





Some damage in felling is inevitable even when the logging is done by expert cutters.

Log skidding to roadside for truck haul. This professional teamster and team were brought by truck more than 60 miles to do this skidding.



In a typical hardwood operation the value of the logs at the roadside may be about half as much again as that of logs in the tree. The difference lies chiefly in the value of the labour required in making the logs and placing them at the roadside. The example which follows shows the typical increase in the value of logs as they are made from the tree and moved to the mill.

Value of the logs at the millyard—\$50 per M board feet		
Costs	{	Hauling logs to mill..... \$ 8
per	{	Skidding logs to road..... \$ 6
M Bd. Ft.	{	Making logs from tree..... \$ 8
		<hr/>
TOTAL.....		\$22

Thus the value of logs in the tree (stumpage) is \$28 per M board feet.

The farmer may easily perform the operations of cutting and skidding, which here total \$14 per thousand board feet, and so increase his return for producing logs on his land by 50 per cent. It is recommended that the Authority carry out a program to encourage farmers to fit the woodlot into the work plan for the farm according to available seasonal labour. The production of no other farm crop offers such time flexibility as woodland work and the relationship between direct expenses and cash receipts is much better for the woodlot enterprise than for the rest of the farm business.

The provision of $\frac{1}{2}$ to 1 man-day of labour per acre per year will improve a woodland so that over the years its dollar yield will be about four times that of unmanaged woodland.

Cutting on shares is also quite common. Under this arrangement a man or a crew go into a woodlot and cut out the saleable logs specified by the owner. They receive no pay from him immediately but take a percentage of the return, usually half, which is realized when the logs are finally sold.

(c) SKIDDING

Though the horse has largely given way to the farm tractor, it is still an indispensable part of the woodland operation. The average cost of skidding is close to \$6 per thousand board feet.

(d) LOADING AND HAULING

Hauling on the Saugeen is done entirely by trucks, the majority of which are privately owned. Hauling distance to the local mills rarely exceeds 50 miles and this would be for grade 1 logs hauled by one of the larger mills. A haul of 15 to 20 miles would be about average and far more common. The smaller softwood mills do not go as far afield. Their average haul distance is about 10 miles with a 25-mile maximum, and costs run from \$3 to \$15 per thousand board feet.

2. THE FUELWOOD OPERATION

The fuelwood operation as a business in itself has largely disappeared from the watershed. This is due, at least in part, to the large number of former fuelwood consumers who now use coal and oil for heat, but a more important

reason is the passing, in both Bruce and Grey Counties, of the minimum diameter limit by-law.

The quantity of fuelwood produced is not immediately evident because of the log buyer's policy of removing the logs and, wherever possible, leaving the tops and culls in the bush as, in effect, part payment. The fuelwood made, and usually consumed, by the farmer-woodlot owner from this logging waste constitutes by far the greatest percentage of the total production.

To have the fuelwood made up costs the owner, in the event that he does not do the work himself, \$2 for a short cord, that is, 8 feet by 4 feet, 14 inches wide, stacked, in the bush. This same 14-inch cord of hardwood fuel sells locally for about \$6 delivered.

3. CEDAR POSTS AND POLES

The Saugeen Watershed is one of the important cedar post- and pole-producing areas in the Province. It has been estimated by those most intimately concerned with cedar products in the area that about 50,000 posts and 5,000 poles are removed annually from the 400 square miles under study in 1951.

POSTS

(Eight feet in length)

<i>Diameter small end</i>	<i>Roadside Price paid per post</i>
2½" to 4".....	10c to 15c
4" to 7".....	30c to 40c
8" to 10".....	80c to \$1.00
Anchor post, 7½" up, 9 ft. long.....	70c to 80c

POLES

(Minimum top diameter 6 inches)

<i>Length in feet</i>	<i>Roadside Price paid per pole</i>
20.....	\$ 1.50 to \$ 2.00
25.....	2.25 to 2.75
30.....	5.00 to 7.00
35.....	8.00 to 10.00
40.....	20.00 to 25.00
45.....	35.00 to 40.00

Cedar is being used more and more for lumber, particularly for two-by-fours and ties. Therefore most logs over 8 inches in diameter are sawn rather than sold as posts. A straight, sound post 9 feet long with a 10-inch top diameter is worth \$2 when sawn into two-by-fours at 50c each. If it is only squared to a 7" x 7" tie it is worth \$1. As an anchor post it is worth only 70c to 80c. Anchor posts therefore are usually those with a little heart rot or crook or both.

The character of the cedar swamp determines its value. Close-grown merchantable stands are the most valuable. Some swamps have other softwoods with the cedar. In this case the cedar posts are usually taken out first and the remaining spruce, pine, balsam or hemlock logs are taken out afterwards in a separate operation, on either a per thousand board feet, or per log, basis. Merchantable softwood swamps are currently valued at from \$25 to \$500 per acre.

4. SAWMILLING

(a) SAWMILLING IN THE AREA

At the time of the survey there were 20 mills on the watershed. Eighteen of these mills were converting logs into lumber or dimension stock while the other two were specialty mills producing basket bottoms. One mill had gone out of business during the past year and another was under construction. The mills varied in size from large well equipped establishments employing fifteen men and producing over 1.5 million board feet of lumber annually down to small truly portable units with a hand-operated carriage.

On the basis of figures supplied by the operators, the 20 mills produce annually just a little less than 7,000,000 board feet. Though this figure represents the amount of sawing done on the watershed it does not necessarily represent the amount of logging. The reasons for this are straightforward. On occasion some of the mills may obtain their logs from woodland which is as much as 60 miles from the mill site, or wherever material is available, and hence much of their supply may come from outside the area studied. Also logs are hauled from within the area to mills outside the watershed boundary. All in all, the amount of material going out of the watershed is probably less than that being brought in because so many of the larger mills within the area are near its boundary. Thus it is possible that the total amount of logging within the area does not exceed 5,000,000 board feet, whereas the milling actually done in the area is almost 7,000,000 board feet.

At a yield rate of about 6,000 board feet per acre and at the current cutting rate, the 20 mills studied are, in effect, more or less clear-cutting an estimated 1,000 acres of unmanaged woodland each year. At this rate the mills in the area are overcutting the size class of timber desired at about two to four times the rate at which it is being replaced. If this condition persists the forest will become dominantly small-sized and the industries dependent upon it will have to radically adjust their consumption rate or look elsewhere for timber. It would take in the neighbourhood of 100,000 acres of productive woodland under practices prevalent in the last twenty years to sustain the current cutting rate, whereas considerably less than half of this acreage exists.

However, if a fair degree of woodland management is soon instituted over the entire area, it can be shown that as the existing woodlands recover they will be able to support the current cutting rate on a sustained basis.

(b) MILL OUTPUT

(1) Daily output for sawmills other than specialty mills varies from 800 to 8,500 board feet with an average sawing rate of 3,000 board feet. The specialty mills (basket bottom manufacturers) consume from 300 to 500 board feet per

day and their output is measured in units of production rather than board feet. As there is more actual sawing done in the specialty mills, their daily output in actual board measure cannot be expected to equal that of the mills producing lumber.

American studies indicate that the output of small sawmills varies directly as the number of men working at the mill, being about 1,000 board feet per day per man—a predominance of hardwood lowering this figure. The average production per day per man in the mills studied on the Saugeen Watershed is near 700 board feet and hardwoods predominate in the area.

(2) RELATIONSHIP—DAILY AND ANNUAL OUTPUT

Assuming 275 working days in a year, at an average production rate of 3,000 board feet per day, the 20 mills on the watershed should produce about 16,500,000 board feet per year. However, the annual production totals less than half this amount. This is because only a few of the mills work a full year and the annual operating time for some is as little as 20 days.

(3) ANNUAL OUTPUT AND CUSTOM OUTPUT

The largest total output among the mills visited is just over $1\frac{1}{2}$ million board feet per year. The twenty mills in the area annually saw about 6,890,000 board feet of lumber of which 10 per cent is custom sawing. In general, as the annual output increases the custom per cent decreases.

(c) CUSTOM SAWING

(1) GENERAL ASPECTS

Although small mill owners do the majority of the custom work they state that custom sawing is not particularly profitable; it is undertaken as a service to the community and as a convenience to the community needs. Large mills definitely discourage custom work.

When a woodlot owner needs a quantity of lumber for a new building or for repair of an old he takes whatever logs he can to the mill. Often the value of the species and the grades that can be sawn from the logs are far above that warranted by the use to which the material is put. He would be well advised to take credit for his logs and let the operator provide him with species and grades best suited to his requirement. The mill owner should supply these at preferred prices where he would be able to dispose of his poorer grades or species of low market value which he has on hand and in return receive a better quality of material which can be put to a more economical use.

(2) RATIO FOR SAWING

The general practice is that charges are made at a set rate per thousand board feet mill run—the rate being common to all species. Some mills charge at a straight hourly rate which covers the time of log handling in the yard, sawing, piling and mill stoppage due to staples, tapping spiles and other metal objects embedded in the logs. Other mills combine the two methods, charging per thousand for average run logs but a comparatively higher rate for small

logs. Unless otherwise understood the slabs, edgings and sawdust which accrue from the sawing belong to the mill operator.

(d) TYPES OF MILLS—PORTABLE AND PERMANENT

The tendency toward the more stationary location of mills rather than numerous truly portable mills reduces the threat to woodlots. The threat is now reduced by the motor transport of logs, *the flexibility of which can be more readily directed to favour woodlot improvement by selective cutting or other good forestry practices.*

(e) FREQUENCY OF SMALL SAWMILLS

When sawmilling first began in this section of the country in the middle 1800's the mills were located where water power was available. As the timber supply within practicable hauling distance of these mills was gradually depleted there was an influx of portable mills which reached a peak about 1915. Since that time the trend has been toward many small mills producing less than 1 million board feet per year and sometimes as little as 30,000 board feet.

(f) MILL PRODUCTS AND BY-PRODUCTS

(1) DIRECT PRODUCTS

Of all the hardwood logs sawn, almost three-quarters go toward the supply of lumber for the local furniture manufacturers. About ten per cent of the total, most of which is softwood, is sawn into construction lumber. The remainder is divided among the other products.

(2) BY-PRODUCTS

Sawmill by-products are slabs, edgings, trim and sawdust. For many years these by-products were either burned or sold for handling costs. At present, however, the demand for them is increasing.

Sawdust disposal still creates a problem for some millers. It is a fire hazard. Water-powered mills must use care to see that it does not get into the stream and cause pollution. Large areas are needed to handle the volume that accumulates and many man-hours of labour are required to haul and spread it. Though for the most part the use of sawdust and shavings in the past has been confined to fuel supply for steam-powered mills, its value is becoming more widely appreciated, particularly as a domestic fuel or in place of straw for stable and poultry-house floors. It has excellent properties for this latter use and when returned to the land it greatly improves the soil.

(g) SPECIALTY MILLS

Specialty mills on the watershed are of two types, those producing dimension stock and those producing basket bottoms.

(1) DIMENSION STOCK MILLS

Dimension stock is lumber which is sawn from particular species for a particular purpose. It is sawn in various widths, lengths and thicknesses

according to the buyer's specifications which in turn are dictated by the capacity of the buyer's machinery which converts it into its ultimate form as rulers, heels, chair rungs, etc.

(2) BASKET BOTTOM MILLS

There are two mills on the watershed sawing basket bottoms, for the common six- and eleven-quart baskets. Poplar and cedar are the two species most used. Basket manufacturers require bottoms to be light and non-resinous. They need not be exceptionally strong. Poplar, though only in fair supply, satisfies these requirements and as it is cheaper than other woods is most favoured. The logs are purchased standing, by the thousand board feet or by the four- or eight-foot cord.

(h) PRODUCT OUTLETS

The softwood mills produce, with few exceptions, construction lumber. Much of this is sold at the mill to local consumers for farm and other building purposes. Local retail lumber yards buy part of the production. Only a comparatively small amount leaves the immediate area, though individual truckers do buy from the mills and resell as far away as Chatham.

Forty-five per cent of the total hardwood production is sawn by the large furniture factories on the watershed, and those factories without mills buy some of their lumber from the smaller local sawmillers. It is estimated that at least 50 per cent of all the hardwood sawn by the mills visited is consumed by the furniture manufacturers in Durham and Hanover. About 10 per cent is exported to the United States. The remaining 40 per cent of the hardwood lumber produced on the watershed is sold to other furniture factories, ruler manufacturers, wooden heel concerns and hardwood lumber wholesalers. These are located in Preston, Listowel, Orillia, Owen Sound, Stratford, Waterloo, Toronto and other parts of the Province.

There are two general sources of raw material from the viewpoint of the sawmill operator. These are (a) timberland owned outright by the operator, or on which he has cutting rights by contract, and (b) open log market purchases. The purchase of logs from these sources can be broken down into five distinct methods. These are listed; the first three apply in source (a) above and the last two apply in source (b).

- (1) purchase of entire farms to obtain the woodlot;
- (2) purchase of woodlot including the land it is on without buying the rest of the farm;
- (3) contracting the cutting rights to a woodlot;
- (4) buying logs at the roadside;
- (5) buying logs delivered to the mill.

A discussion of the five methods of acquiring logs follows:

(1) BUYING FARMS

The outright purchase of entire farms to obtain the woodlot is practised only by the larger mills. Such purchases demand a considerable capital investment, which limits this field to certain operators.

(2) OUTRIGHT PURCHASE OF WOODLOTS

When woodlots have been purchased outright, as when farms have been purchased and resold with retention of deed to the woodlot, the sawmiller or log contractor is left after harvest with a bush that has no ready market value as all the merchantable timber has been removed. Sometimes it can be sold to the farmer who owns the adjacent property, but the monetary return for bush of this kind is indeed small. It is therefore felt by some that continued ownership is advisable. As one operator said, "I keep it as a sort of insurance policy for future supply".

(3) CONTRACTING THE CUTTING RIGHTS

As with outright purchase, the contracting of cutting rights involves a cruise of the woodlot by the buyer to provide an estimate of the quantity and quality of standing timber which is followed by an offer of payment on whatever terms are agreeable to both parties. "Methods of Payment" are further explained in the later text.

(4) BUYING LOGS AT ROADSIDE

Most farmer-made logs are bought in this manner. The woodlot owner either cuts the logs himself during the winter months or has them cut on a cash or share basis, skids them to a roadside and sells them piled in the skidway. The logs are purchased by the thousand board feet (Doyle Rule), the buyer paying hauling costs to the mill.

(5) BUYING DELIVERED LOGS

Delivered logs form another important source of raw material for the saw-mills. Though some mills which own their own trucks do not buy in this manner, others rely entirely upon delivered logs and the majority of mills buy some. Mills which buy both roadside and delivered logs allow a fair price differential to cover the cost of hauling if the log seller wishes to deliver. The mills do not allow more than they themselves would have to spend for the service, but neither do they attempt to profit from their own trucking facilities. For this reason a mill which has its own trucks can usually haul more cheaply than the private trucker; therefore if the log maker does not have access to a logging truck he is, when dealing with a mill which has a trucking service, likely to sell his logs at the roadside, leaving the haul to the buyer.

(i) METHODS OF PAYMENT FOR LOGS

The woodlot owner may receive payment for his timber on a lump sum basis, at a price per thousand board feet on the stump or a price per thousand board feet made into logs.

(1) LUMP SUM TRANSACTIONS

Many of the larger timber operators prefer to purchase their requirements by the lump sum method. The most competent buyers can successfully offer winning tenders and leave themselves the necessary safety margin to take care of the logging chance. Realization on the venture is greater according to the buyer's ability to carry through operations on a better cost sale ratio than was

used in his calculations setting the lump sum bid. The buyer accepts this challenge to his abilities and in the long run hopes that the chance taken proves profitable. It is not always so. Buying logs in skids or delivered to the mill and paying for them at a price per thousand board feet removes the financial risk to the operator of outright purchase and payment by lump sum, but it also removes the chance for the extra margin of profit which is a measure of the ability and accuracy of the stumpage buyer.

(2) STUMPAGE RATE TRANSACTIONS

Some buyers will purchase only by the lump sum method of payment but most will consider either the lump sum or volume removed basis. The woodlot owner must decide whether he will do better to accept the lump sum offered, leaving the risk of log grade and volume recovered to the buyer, or to sell at so much per thousand board feet and accept the risk himself.

In the event that he chooses to be paid on a volume removed basis, just what the buyer intends to cut and pay for should be absolutely clear. Only the best trees might be removed and it is possible that only the best logs from these trees might be taken. This leaves the owner with many poor quality logs which he cannot sell readily and with some poor trees standing which he wanted cut. The volume actually paid for might be small and the woodlot owner's total realization on the transaction might be less than he would have received had he accepted payment in a lump sum.

No matter which of these two methods is chosen, a written Timber Sales Contract should cover the transaction.

(3) OWNER-MADE LOG TRANSACTIONS

The woodlot owner who has decided to realize not only the value of his woodland product but also the additional labour income derived from its harvest prefers to take payment at a price per thousand board feet for logs placed on skids at the roadway or logs delivered to the mill. Currently sawmills pay from \$15 to \$25 more per thousand board feet for logs delivered than they do for standing timber. Although the number of farmers doing their own harvesting has been on the increase, due in part to increased quantities of second- and third-growth timber plus the desire for slack season income during the winter months, the present combined output of all farmers is not great enough to supply the needs of the existing sawmills.

(j) LOG PURCHASE PRICES—LOG GRADES

Logs are graded on the visible defects, allowance for hidden defects such as those caused by old maple syrup spiles or overgrown limb stubs proving a problem. The effects of the various defects or combination of defects on the grade-volume outrun of the lumber at the mill is not easy to appraise, and only those with considerable experience at the headsaw and at grading lumber can attempt it. Since probable grade output per log is important the buyer considers this when buying stumpage or logs. Generally operators classify logs in at least three grades, and sometimes four, and pay for logs according to these grades.

Selective logging. The 21-inch maple in the foreground is blazed for removal while the 16-inch maple in the background has been left. At the smaller size hard maple is putting on its "quality growth".



Some operators do not pay their Grade 1 prices for logs with centre defect, while others do. Maple syrup spiles caused the small dark marks seen on this butt log.



Sometimes the grading rules are rigid, but in most cases in that area of the Saugeen Watershed under study in the summer of 1951 they were found to vary from flexible to vague, in fact a few buyers did not grade at all but bought at a set price per thousand board feet bush run. However, even with those who have reasonably well defined log grading specifications, the specifications are rarely available in a tabulated form to a log seller. The log buyer simply keeps in mind certain basic principles and grades on his knowledge of what can be sawn from each log. Log grading rules therefore are not only indefinite but also vary from one operator to the next. This lack of standardization, lack of publication and the obscurity of log-grading rules increases the general confusion regarding them to the extent that it becomes extremely difficult, if not actually impossible, for the woodlot owner to compare the log price-grades of different buyers—and a quoted price per thousand board feet actually means very little to the man selling logs.

A good buyer, in making a stumpage purchase on a per thousand basis by log grade, will walk the woodlot with the owner and try to illustrate the various log grades according to external appearance. In this way the owner is more likely to receive an idea of the probable log-grade run in the sale.

Much of the skepticism in the minds of the woodlot owners toward dealing with log buyers would disappear if there was less obscuring of the grading standards. Some buyers feel that they must say that they operate with open books. Generally this is true. A good way to show this is to make available price lists and general log grade specifications together.

It is evident therefore that the grading rules *must* also be standardized if the woodlot owner is to achieve an understanding of the rules comprehensive enough to enable him to effectively compare the prices offered by different buyers and thereby choose and receive the maximum market price for his logs.

5. LOCAL WOOD-USING INDUSTRIES

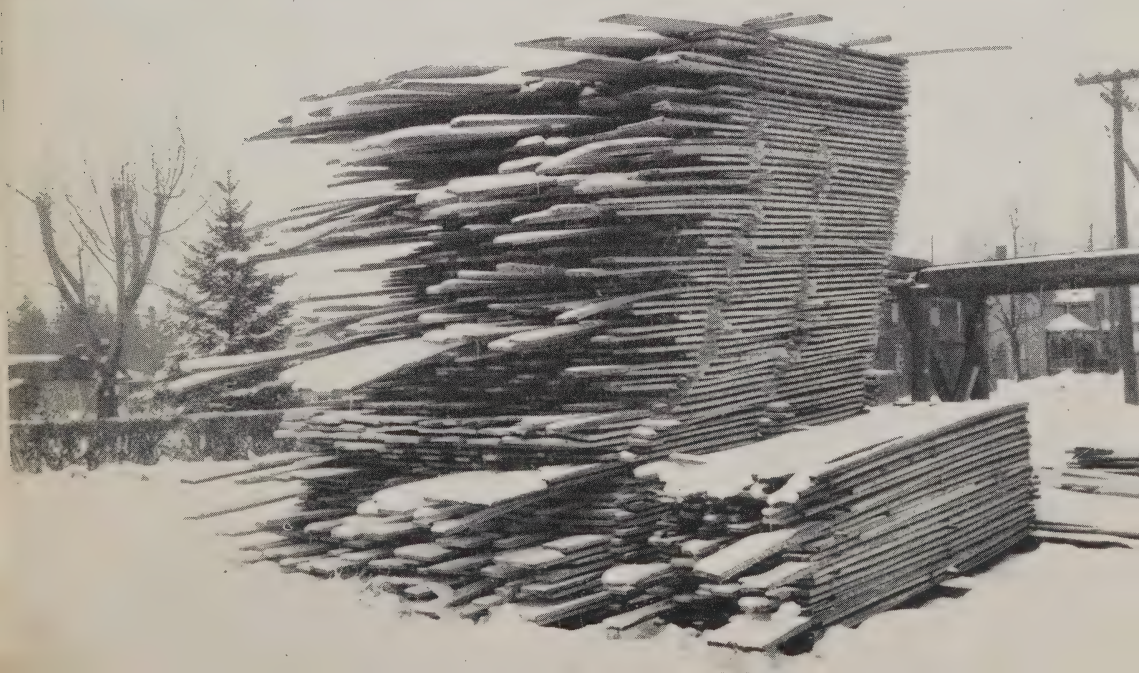
In the area, nine establishments qualified as wood-using industries. Seven of these are in the town of Hanover. All but one manufacture some type of furniture. Four of the nine turn out only, or specialize in, bedroom and dining-room furniture and their products are known nationally. Another four manufacture hotel, restaurant and office fixtures, chairs, cabinets, sash and doors, cocktail tables and metal and wooden kitchen furniture. The exception mentioned, which does not make furniture, produces baseball bats, neck yokes, whiffle trees and peevie handles. It is doubtful if the watershed supplies more than 10 to 20 per cent of the total wood consumed by the nine resident wood-using industries. This percentage varies among the individual establishments from 0 to 30.

Local species used, in order of quantity, are hard maple, soft maple, soft elm, white and yellow birch, beech, basswood, white ash, black cherry and a little hickory. Maple and birch are in the greatest demand for furniture facing and the local supply, particularly of yellow birch, is not sufficient. Much yellow birch therefore is "imported" from Northern Ontario and Quebec, as for the same reason is basswood. The United States supplies much of the oak and



Farmers often do very little of the woods work. This lump sum purchase bought only the logs that could be made. The farmer paid the buyer's cutting crew to make the tops and limbs into 4-foot fuelwood.

Poor piling of random lengths. The grade of lumber is often lowered during seasoning due to poor piling practices which encourage warping.



walnut used and mahogany comes from as far as West Africa and India. Much of the plywood used in the area comes from the veneer plant at Southampton at the mouth of the Saugeen River.

Of the softwoods used, spruce, balsam, hemlock, cedar and white pine are grown locally but, as with hardwood, there is not enough for the needs of the local wood-using industries. Spruce crating is imported from Quebec and Northern Ontario, and Tennessee supplies a great deal of aromatic red cedar.

6. THE MARKETING PROBLEM

The marketing problem has three closely related aspects:

- (a) The woodlot owner who has merchantable trees that will make sawlogs. The sale of his woodlot increment should be a paying proposition the same as any agricultural enterprise.
- (b) The professional or semi-professional sawmill-operator who requires logs that he can mill into lumber on a paying basis.
- (c) The ultimate industrial consumer who requires definite quantities of certain species in certain grades in order to carry on his manufacturing on a paying basis.

These aspects resolve into getting the woodland products to the mills in sufficient quantity to make their handling profitable to the woodlot owner and the sawmiller, and assuring the consumer a continuous supply of standard grades at fair prices.

In the past the farmer has been at a disadvantage in marketing logs from his woodland. In lump sum sale he must rely on his ability as a trader to strike the best possible bargain with the buyer. He is unfamiliar with methods of estimating the quantity and value of his merchantable timber; experienced foresters find it difficult to estimate accurately cull and quality when appraising timber, particularly hardwoods, which predominate in the area studied. The buyer has had experience in this field and in addition allows a safety margin on the estimate. Furthermore, operators of small mills and portable mills are often at a disadvantage in marketing their lumber and so are not in a position to pay full value for standing timber. Sale methods involving stripping the woodland ruin the woodlot for decades to come. Sale by set price per thousand board feet removed gives the operator the right to cut all or certain trees above a specified diameter and to take only those portions of the trees he wishes and to pay for only the portion he takes. This pattern of sale removes the uncertainty of the cull and quality factors but introduces the question of how much of the timber cut will actually be taken; it often is high-grading the woodlot and "creaming" the logs of the felled trees. Thus a high price offer per thousand on the stump may bring a lower price to the farmer than the lump sum method. The log scale used in buying standing timber introduces another variable. Opportunity for sharp practice in scaling the felled logs exists, particularly when allowance is made for cull in defective timber. However, in fairness to log buyers it must be said that the majority are not of the type just mentioned.

The professional or semi-professional sawmiller requires assurance of log supply. The lack of interest by many woodlot owners in any form of logging operation of their woodlots forces him to sell the idea of log sale to the owners. To assure log supply to his sawmill he is in many cases forced to buy woodlots in order to plan his milling for the year. Sporadic supply by purchase on the open log market is too indefinite. In buying woodland for a season's milling he may acquire such volume as to remove strong interest in log purchase in small quantities from individual farmers. The disposition of his cut is often quite a problem. The preponderance of low grades in average hardwood milling, in many cases increased by poor sawing equipment and techniques (especially degrading due to poor piling), make efficient grading and separate piling of the many species sawn a serious problem. The resulting common practice is mixed-grade piling and forces him to sell lumber piles at reduced prices rather than at good prices by specific grades. His established market has considerable dependence upon mutual goodwill with the purchaser.

The industrial consumer most often requires quantities and specific grades in large lots of a carload (approximately 20,000 board feet) and up. He desires well-sawn products of standard widths and thicknesses. Most large consumers must "import" other than local species from large mills which also handle large quantities of well-graded woods which may be sawn locally. It may be more practical from his point of view to pay the extra freight costs involved to be assured of continuous supply of species and grades as required than to "shop around" in an uncertain local supply market.

7. ATTEMPTS AT A SOLUTION OF THE MARKETING PROBLEM

(a) A MARKETING EXPERIMENT NEAR DOON

During the winter season of 1948 and 1949 the Department of Lands and Forests in the Galt Zone carried out an experiment in the marking and marketing of timber in an 18-acre woodlot near Doon. The woodlot owner entered into a signed agreement with the Department as a co-operator, agreeing not to sell or allow to be cut any trees except those marked, upon penalty of a nominal fine per thousand for the estimating and marking service of the Department.

Each tree marked for removal was blazed at breast height and below stump height, the stump blaze being branded to detect any unauthorized cutting. The total log scale estimated for the 223 trees marked was 47,600 board feet Doyle Rule. The trees were tabled as to species and diameter on a mimeographed form.

All the estimation data were turned over to a timber agent chosen by the Department. The timber agent, who received a percentage commission, entered into written agreement with the owner to

- (1) solicit tenders from buyers;
- (2) draw up a timber sale contract protecting the owner;
- (3) check on cutting operations; and
- (4) measure and collect payment for all wood cut before its removal from the property.

Prices realized by the owner were much better than the average paid in the area. Prices per thousand board feet Doyle Rule for the standing timber were :

White and red oak.....	\$62
White ash, soft maple, hard maple, basswood and cherry	\$60
White pine.....	\$55
Hemlock.....	\$45
Beech.....	\$30
Fuelwood.....	\$4 per standard cord

The experiment was considered very successful by all the parties concerned, yielding about 2,000 board feet more than estimated, and the woodlot has been left in fine growing condition with an expected second cut in fifteen or twenty years of 25,000 board feet.

(b) FOREST PRODUCTS CO-OPERATIVE IN NEW YORK STATE

In Otsego County in New York State local interest in forestry, stimulated by critical needs arising from the depression, resulted in the organization of the Otsego Forest Products Co-operative Association at Phoenix near Cooperstown in 1935 as a farmer co-operative under the co-operative corporation laws of New York State.

To become a member a person must be a woodlot owner, must purchase five shares of common stock at \$1 per share and must sign the Association's Marketing Agreement. The member thereby agrees to manage his woodlot according to good forestry practices and to sell any sawlogs cut by him for sale to the Co-operative and to accept 5 per cent of the value of his logs in common stock. Members receive patronage dividends. The Association agrees to assist the owner in applying good forest practices to his woodlot and to publish prices and grading specifications for logs on a delivered-to-the-mill basis and, should it be unable to handle the member's forest products advantageously, to give permission to sell them elsewhere. Lumber needs of members are met at wholesale prices at the mill. By 1941 the Association had a membership of over 600; this had increased to almost 1,100 by the spring of 1950.

Demonstrating in many ways the economic advantages of co-operative action, the Association has largely overcome many of the obstacles that make intensive forest management on a continuous yield basis impractical without a market that will absorb all classes of products, pay fair prices and accept delivery in small quantities from widely dispersed farm forestry enterprises.

(c) THE LANARK COUNTY CO-OPERATIVE

The Co-operative was set up by a group of woodland owners in the County of Lanark in March, 1950. Its objectives are the better management of privately owned woodland to ensure a continuous yield of the best material possible from the forested land of the members through profitable marketing of all the woodland products.

8. TIMBER SALE CONTRACTS

As an aid to people who are unfamiliar with timber sale agreements, a sample contract is given here. It shows the more important provisions that

should be included in a contract for the sale of marked trees to be scaled in the log. Substitute clauses are given for use in other kinds of sales. No single form of contract will suit all classes of sales, but owners of woodland timber should have no difficulty in adapting this contract to their use.

SAMPLE TIMBER SALE CONTRACT

Agreement entered into on this.....day of.....
between.....of.....
hereinafter called the seller, and.....of.....
.....hereinafter called the purchaser.

Witnesseth:

ARTICLE I. The seller agrees to sell the purchaser, upon the terms and conditions hereinafter stated, all the living timber marked or designated by the seller and all the merchantable dead timber, standing or down, estimated to be.....board feet, more or less, on Lot.....Con.....in the Township of.....County of.....and located on a farm owned by the seller and about.....miles from.....

ARTICLE II. The purchaser agrees to pay the seller the sum of....., more or less, as may be determined by the actual scale, at the rate of.....per thousand feet for.....payable prior to the date of removal of material, in instalments of.....each.

ARTICLE III. The purchaser further agrees to cut and remove said timber in strict accordance with the following conditions:

- 1. Unless an extension of time is granted, all timber shall be cut, paid for, and removed on or before.....
- 2. Saw timber shall be scaled by the.....log rule, and measured at the.....
- 3. The maximum scaling lengths of logs shall be 16 feet; greater lengths shall be scaled as two or more logs. Upon all logs an additional length of 4 inches shall be allowed for trimming. Logs overrunning this allowance shall be scaled not to exceed the next foot in length.
- 4. No unmarked timber of any kind shall be cut, except.....
- 5. Stumps shall be cut so as to cause the least possible waste-stumps of trees up to 16 inches in diameter, not higher than 12 inches above the ground, and those of trees above this size at a distance above the ground not greater than three-fourths of their diameter.
- 6. All trees shall be utilized in their tops to the lowest possible diameter, for commercially saleable material.

7. Young trees shall be protected against unnecessary injury; only dead trees and less valuable kinds may be used for construction purposes in connection with lumbering operations.

8. Care shall be exercised at all times by the purchaser and his employees against starting and spreading of fire.

ARTICLE IV. It is mutually understood and agreed by and between the parties heretofore mentioned as follows:

1. All timber included in this agreement shall remain the property of the seller until paid for in full.

2. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by parties to this contract, and in case of further disagreement, with an arbitration board of three persons, one to be selected by each party to this contract and a third to be the Zone Forester or his chosen representative.

In witness whereof the parties hereto have hereunto set their hand and seal this..... day of.....19....

Witnesses:

.....
.....

The following are sample clauses that should be substituted in the contract when other methods of sale are used. In lump sum sales, substitute in Article I a descriptive clause, modelled on this one:

All merchantable living trees, except.....which measure, 12 inches or less in diameter at breast height (a height of 4½ feet above the ground).

Such provision will reserve the basis of a second crop consisting of the more valuable and rapid-growing kinds of trees and remove all the inferior and slower-growing trees.

The payment clause in lump sum sales should be varied to read somewhat like this:

The sum of.....dollars.....for said timber, payable prior to the cutting of the material, in instalments of.....dollars.....each, payable on or before.....respectively.

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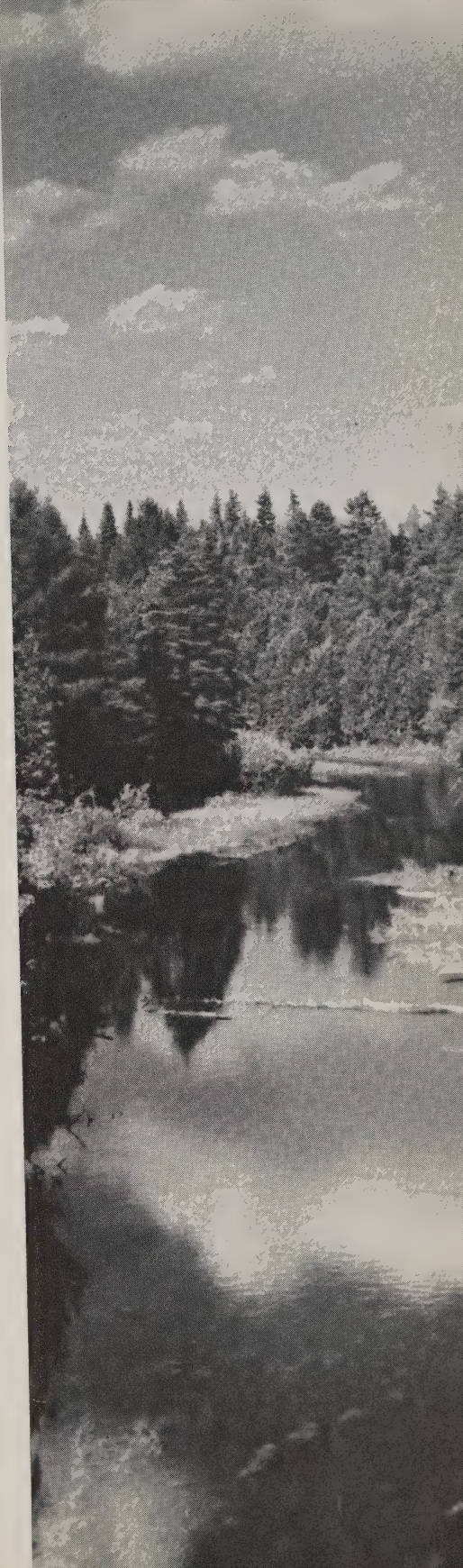
WATER

CHAPTER 1

THE RIVER

The Saugeen River has its source in the south-eastern township of the County of Grey and in the adjacent parts of the Counties of Wellington and Dufferin and flows in a westerly and then a north-westerly direction to the town of Southampton in the County of Bruce, where it empties into Lake Huron. The total area of the watershed is 1,545.57 square miles, lying in the five counties of Grey, Bruce, Wellington, Huron and Dufferin.

The name Saugeen, though variously spelled, is the only name by which the main stream of this river has been generally known to white men. Charles Rankin, in running his original line for the Garafraxa-Owen Sound Road in 1837, called it the "Rapid River", per-



haps because he was not certain of its identity as "a Saugeen". An Indian authority, writing in 1858, gave the following account of the name and its derivation:

"Saugeen, or Suggeen, as some people would have it, I believe, professes to be an Indian word. If so, in order to make sense of it, the letter g should be added at the end of the word, and it would be more proper to write and spell the name S A H G I N G, and the length of its pronunciation should be about the same as that of the word 'sea-king'. It may be rendered in English, the 'outlet', or the 'mouth of a river', though it is not the correct translation. The word is derived from *Sahkum*, which in Odahwah (Ottawa) signified to come out. In Ojibwa the K is changed into g, and another syllable added, and the word is written and pronounced *Sagahum*. Sahging is a participial noun, and implies motion as well as an open space, and every river has its *sahging*, or outlet."

The mouth of the Saugeen River appears on Bayfield's chart of Lake Huron, 1822, where its interest to navigators is indicated in a few words: "River Saugink, 6 feet over the bar it becomes shoal and rapid 200 fms. within the entrance". In other words, while a vessel might find shelter near the entrance, the river above the rapids was not considered navigable. On his arrival at the mouth of the Saugeen in 1831 the Wesleyan missionary, John Benham, wrote: "The River moves briskly, but I think is navigable for boats". Twenty years later, when settlers began to move into the lands along the lower parts of the river, many of them rafted down the river from Buck's Crossing (Hanover) or from Walker's (Walkerton), but travel up stream was limited to short-range or emergency journeys in light canoes.

Some particulars of the character of the river are set forth in a Directory of the County of Grey, published in 1865.

"The Saugeen, though not a navigable river, is one of the three or four larger streams found in the Western part of Upper Canada. . . . Its course is very devious; from its source to Walkerton is about 40 miles in a direct line, and from that town to the mouth of the river is but little over 30 miles direct, making 70 miles for the course of the river; yet, from its many windings, it must flow over 100 miles. The Saugeen is remarkable for its many branches. It has no fewer than five large tributaries, some of them dignified with the appellation of 'Rivers'. In the County of Grey, on the main stream, are the villages of Priceville, Durham and Hanover; on the South Fork (the so-called 'Maitland' of former days), are Cedarville, Mount Forest, Ayton and Neustadt. The Saugeen and all its numerous branches present an almost unlimited number of water-privileges; not a tithe of which are as yet used for manufacturing. . . . At the mouth of the Saugeen, a pier has been projected into the Lake, which not only gives shelter to vessels entering, but by narrowing the channel, tends to deepen the water over the Bar. The depth, however, is not great, and large vessels do not often come into the river. Half a mile up from the mouth, swift water is reached."

The principal tributaries of the Saugeen River are the North Branch, the Rocky Saugeen, the Beatty Saugeen, the South Branch, and the Teeswater River. The North Branch appears always to have been so called; the others have, from time to time, been known by other names.

In his survey of 1837, Charles Rankin refers to the Rocky Saugeen as the Fox River and to the Beatty Saugeen as the Deep Gully River. These names, along with that of Rapid River for the Main Saugeen, appear never to have gained general currency.

Rankin, presumably on the advice of his Indian guides, took the South Branch to be "the Southern or Main branch of the Saugin". When, in 1841, John McDonald was instructed to complete the work that Rankin had begun in 1837, a mistake was introduced that persisted through more than twenty years, for McDonald's Indians advised him that the river he crossed in the north-west corner of Arthur Township was the Maitland.

Mount Forest, that had earlier been called Maitland Hills, was incorporated as a village in 1865, its new name reflecting the correction of the "old error"; and it is probable that at least along the banks of the stream concerned, the South Branch was at last properly identified and fittingly named.

The branch of the Saugeen now known as the Teeswater River was called by the Indians the Ah-ta-yahko-sibbi (Drowned Lands River), a name that the white pioneers corrupted to Yokasippi. To the early settlers it came to be known as the Mud River, and many called it (from the township through which it flowed) the Greenock River. In 1850 Allan Park Brough, surveying in Greenock Township, observed that "those flats on the East side of the Ahshushkisibi will, when cleared, make very good Meadow ground", and entered in his field notes: "Meet the edge of the Ahshushkisibi or Muddy River". In the following year, 1851, Brough referred to this stream as "a large tributary which I have named the Teeswater". For many years, the homelier name of "Mud River" persisted, but official usage ultimately prevailed, and the name "Teeswater" is now, after more than a hundred years, the only name generally applied to the branch in question. Brough did not state his reason for his choice of name; the original Tees forms a part of the boundary between Durham and York in England.

The watershed is roughly a rectangle lying due east and west, measuring about 50 miles east and west and 31 miles north and south. It is drained by the Main Saugeen, five major tributaries and numerous smaller ones. The drainage areas of these are as follows:

TABLE H-1
DRAINAGE AREA, RIVER AND TRIBUTARIES

Stream	Drainage Area Square Miles	% of Total Area
Main Saugeen River.....	655.35	42.40
North " ".....	102.45	6.63
Rocky " ".....	110.73	7.16
Beatty " ".....	100.71	6.52
South " ".....	312.09	20.19
Teeswater River.....	264.24	17.10
Total Area of Watershed...	1,545.57	100.00

The Main Saugeen from the headwaters to its mouth is about 120 miles long, has a total fall of about 1,150 feet and an average gradient of 17.9 feet to the mile.

CHAPTER 2

FLOODS (1837-1951)

The first flood on the Saugeen of which any record has been found occurred in 1837. In that year the surveyor Charles Rankin was running the line for a proposed road from Garafraxa to Owen Sound (which was never opened) when he was delayed in his crossing of the Saugeen by high water. He arrived at the south bank of the river, at a point about three miles west of Durham, on the 8th of June, 1837, after two days of continuous rain, and entered in his diary:

"Ran N 9° W 2 miles to a large river or stream, suppose the main branch of the Saugeen, flooded so as to be impassable on the line, and from the nature of opposite (North) shore a broad flat, deeply inundated, unfit for road. Encamped a little way down the river where we find it possible to pass it."

Rankin's only concern was with the delay the flood caused in his work, and he felt no necessity to record the depth of the inundation that he observed. It is of special interest to note, however, that this flood took place in June, and not at break-up time, and that it occurred before any of the land in the upper part of the watershed had been cleared.

The next recorded flood took place in April, 1851, and has been described, not by a surveyor, but by a young man who was on his way to the "Saugeen Country" to settle. David Kennedy, in a book of reminiscences written in 1902, tells how in 1851 he built a scow at "Buck's Crossing" (Hanover) to carry himself and several others down the river. When the party were at last ready to set out, they encountered an unexpected delay. The river rose in flood so high as to prevent their passing their scow under the bridge at "Walker's", the present Walkerton. As the bridge was built twenty feet above "low-water level", it seems that this flood must have been nearly that height above normal; the high water persisted from the 10th to the 13th of April.

A flood took place in the vicinity of Hanover in May of 1852, when John D. Daniell was surveying in the nearby township of Carrick. On the 11th of May he records that the Main Saugeen was "much swollen; Crossways all destroyed by the floods". And on the 15th: "Could not cross the River, water was so deep at the Time".

After 1852, there is a period of ten years concerning which no records of floods on the Saugeen are available. It does not necessarily follow that there were no floods.

The Toronto Globe of April 25, 1862, quotes from the Walkerton Herald an account of a flood near that town.

"It was much feared that the bridges would not be able to withstand the force of the current. At Traynor's bridge in the township of Brant, a large jam,



On March 17, 1948, the Saugeen River flooded part of Walkerton, doing considerable damage. This shows conditions at the intersection of Durham and Jackson Streets.

The local press was also inundated by the rampaging Saugeen River.



composed of hewed lumber and whole trees, gathered in spite of all efforts to disperse it, and on Friday night (April 18th), the whole structure gave way before the immense pressure, and started down the stream. . . . The bridge commonly known as 'Crispin's' has also been carried away."

At the same time, the South Branch at Mount Forest was described as being in a state of "terrible freshet, destroying mills and other valuable property." This is the first time that mention is made of any serious property damage; it marks the beginning of a tendency to measure the severity of the floods, not by the height to which the waters rise, but by the value of the property they destroy.

The flood of March 17, 1868, must have been of unusual severity. The Toronto Globe reported that the lower portion of Paisley was "almost entirely covered by water", and that the Saugeen and the Teeswater had risen "five or six feet higher than the oldest settler remembers having seen them", the waters flowing over the counters in some of the stores. Valentine's dam, on the Teeswater, was slightly damaged. It is probable that some damage was done at other points on the river, but reports are lacking.

Again, in 1869, the freshet of March 30 is reported only from Southampton, though it must have been felt at other points as well. According to the Toronto Globe, "the bridges on the Saugeen River have been carried off by a freshet, and the only way travellers can now get to Southampton is either by Port Elgin or through Arran, via Stack's Corners". At the time of report the river was still rising; but the next few issues of the Globe have no further mention of the flood that was "expected". There was, however, a second flood in 1869, when the South Branch was in freshet on April 22 and "nearly all the mill-dams" in the neighbourhood of Mount Forest were carried away. Yeoman's dam at Mount Forest was one of those destroyed, and in its fall it carried away one of the piers of the bridge across the Owen Sound road, endangering the whole bridge; but the bridge was not destroyed.

The next severe flood on the Saugeen occurred in 1872. On April 9 of that year a bridge over the river near Port Elgin was carried away; a number of houses in Southampton were destroyed; and a boom of three thousand logs at Walkerton was lost.

The April flood that occurred in the next year must also have been severe, but the report of it is meagre and is limited to the vicinity of Durham. It was reported on April 17, 1873, that "Mr. Purdy's mills, in the township of Glenelg, on the Saugeen River, and Patterson's mill-dam, in Durham, have been carried away".

In the winter of 1882-83, there was an unusual accumulation of snow, which resulted in great floods along the Teeswater River during the ensuing spring, with some damage in the village of Pinkerton. Evidence of these floods was submitted in the course of an action for damages brought by Pinkerton against the Township of Greenock in 1906, and is referred to in the official report of the trial; but no details of the damage are given.

A severe flood took place at Walkerton on the 24th of February, 1891, when, according to a report to the Toronto Globe, "the new iron bridge recently

erected at the Young street crossing" was carried away: "The bridge was carried away bodily, and now rests on the bottom of the river a hundred yards from its former position."

The Toronto Globe of March 17, 1913, made reference to a flood at Durham in 1893, but did not give the exact date, stating only that it had been caused by an ice jam. No other reference to this flood has been found.

In the spring of 1895, there was again a flood at Pinkerton of which complaint had to be made to the Township of Greenock. The circumstances were reviewed in the course of a trial in 1906. Of the four floods referred to in the report of this trial no contemporary accounts have been found.

A severe flood in 1907 was reported from Southampton. On March 22 of that year, "Denny's bridge, on the Saugeen River, two miles east of here, was carried away by the ice". Fears were entertained for the safety of the Victoria Street bridge; and the Saugeen Electric Light Company's plant, which supplied light to Southampton and Port Elgin, was damaged and put out of service.

The Toronto Globe of April 18, 1908, published a photograph of a flood scene, with the caption (undated): "Spring Floods at Mt. Forest". Nothing further is known of this flood on the Saugeen, but, as there were floods at about the same time on the Maitland and the Bayfield Rivers, it seems likely that the Mount Forest freshet took place not many days before the publication of the photograph. There is no indication of any damage done.

There was high water on the Teeswater on March 22, 1910, but no report of any damage to property. The "swollen condition of the river and the strong current", however, were the cause of the drowning of three women who attempted to cross the Teeswater half a mile above Grant's Bridge, at Semple's farm; "the boat was swept down the river and overturned before they had taken hold of the oars".

The flood of April 7, 1912, was referred to as the "greatest flood in forty years". Great damage was done at Durham, Paisley and Southampton. At Durham, the Canadian Pacific Railway bridge collapsed in the sight of hundreds of spectators. Streets were flooded in Walkerton. At Paisley, residents had to be rescued from their homes by boat, two mill dams were swept away. Mill dams at Pinkerton and Lockerby were badly damaged. Two large bridges over the Saugeen at Southampton collapsed, and the electric light plant was again put out of commission. "All the bridges on the Saugeen River are threatened with destruction, and there has been great destruction in all the towns along the river."

On March 16, 1913, the Saugeen was once more on the rampage. At Durham, the dam of McGowan's mills was swept away, causing a loss of \$4,000; and an ice jam lodged against the Canadian Pacific Railway bridge, endangering that structure. The jam backed the waters up until they found a new outlet by flowing through the streets of the lower town at Lambton Street, crossing Main Street several inches deep and flooding many cellars.

From 1913 on there follows an interval of 13 years during which no accounts of floods on the Saugeen are available; whether any floods occurred in these years is not clear.

The flood of April 25, 1926, was one of the worst on record, at least in Hanover, where estimates of the damage to the dam alone ran as high as \$100,000. The Toronto Globe carried a Hanover dispatch dated April 26:

"The damage from floods in Hanover caused by the rising waters of the Saugeen River during yesterday and today will probably exceed \$150,000. The big dam owned by the Canada Cement Company here broke away yesterday, while the two bridges in the vicinity were also swept away. One bridge was situated at the Bruce-Grey County line, just outside the town limits, and the other between Hanover and Durham. Damage to property in the flooded section of the town will also amount to a considerable sum."

The Stratford Beacon-Herald of March 16, 1929, reported high water at Walkerton, but no serious damage done. Three weeks later, on April 6, Mildmay and Neustadt were among the communities that were hit by the "worst floods in all their history". On the 7th, Mildmay was recovering from the floods, and estimating damage in the village at approximately \$100,000. Dams and bridges were swept away, factories and dwellings collapsed, and sawmill owners lost heavily through timber being washed into the river. The dams at Cargill and Pinkerton were reported to be the only ones left standing on the Teeswater River. "A number of bridges in Brant were swept out yesterday." At Neustadt the damage was estimated at \$75,000. The water flooded all the stores on Main Street and several homes. One brick dwelling collapsed, and the family had a narrow escape from death. At the same date the Canadian National Railway reported fifty bridges, large and small, in need of repair in the vicinity of Hanover and Bentinck Township.

A February flood in 1932 was severe in the vicinity of Southampton and Port Elgin, but was not widespread. On the 13th of that month

"The Saugeen River went into a flood stage, broke through the milldam, and carried away part of the old grist mill operated by Mrs. Sarah Bell. The mill is a Port Elgin landmark, which has withstood time and tempest. . . . Some of the streets of Southampton are flooded, and men are working hard endeavoring to turn the rushing water away from the town. Many cellars are flooded."

In 1937, Silver Creek at Walkerton was in flood on the 10th of February, but no serious damage was done. The very severe floods that devastated parts of London in 1937 had no counterpart on the Saugeen. No floods were reported there during the month of April in that year.

Then follows a period of eight years without any known reports of floods on the Saugeen. The next flood was apparently that of July, 1945, when the river at Durham "rose 8 feet in two hours", but seems to have caused no damage. The floods of April, 1947, however, were both more severe and more general. On April 11, 1947,

"a four-block area in Walkerton was flooded by the Saugeen River. . . . A boat was used to navigate the one and a half block section of the main street which was under water. Cellars of all stores along the street were flooded.



Jackson Street, Walkerton, looking north toward the C.P.R. station. This, and the picture below, were taken on March 17, 1948.

Colbourne Street, Walkerton, looking north from Durham Street toward the C.P.R. bridge.



The Saugeen flood tied up the Canadian National Railways line between Hanover and Neustadt."

The water at Walkerton was eight feet above normal.

In 1948, Walkerton was again flooded, and several families had to be removed from their homes. Pumps had to be used to keep water out of the telephone exchange. On March 21 the village of Paisley was flooded, the water being fifteen feet above normal; twelve families had to leave their homes. Both Southampton and Paisley reported heavy damage.

At Hanover, Walkerton and Durham, there was serious flooding by the Saugeen River on the 23rd of December, 1949, but actual damage was limited to the flooding of some basements in Walkerton.

In April, 1950, another flood took place, only slightly more severe than that of the previous December. On April 5 Paisley reported fourteen homes surrounded by water. At Walkerton, three factories were forced to close, and fifteen houses were surrounded. Highway No. 4 was closed by floods near Hanover. And on the same date the Canadian National Railway had to suspend service between Neustadt and Hanover because of "water over the rails".

The floods at Walkerton were by now coming to be almost an annual event, and a flood on the 30th of March, 1951, occasioned no great excitement. It was not a severe flood, and the river rose only four feet above normal. The year 1951, however, was to bring to Walkerton its second flood of the year, and this one rather more serious. On the 26th of April both Walkerton and Hanover had their streets flooded, though actual damage was not extensive.

According to the Chesley Enterprise, on March 20, 1952, the spring break-up came on the Saugeen, and the ice "went out" without causing any damage.

In the course of the 116 years that have elapsed since 1837, there are well-authenticated records of 36 periods of high water of varying degrees of severity.

But there is in these data no indication of a tendency toward either increased frequency of floods or increased severity. There is a strong probability that in the earlier decades of the period under consideration some floods passed without being either observed or recorded, and that the improved news services of the more recent decades had left few if any floods unreported. That the later floods have in some cases occasioned greater property damage than did the earlier ones is the result of the increasing value of the property exposed to flooding, rather than to the increased severity of the flood or to the height to which the waters have risen.

The available records of flood damage on the Saugeen River do not provide a proper basis for estimating the extent of the property damage done. Even in the case of floods which appear to have been fairly widespread, the published reports do not, as a rule, tell of conditions in more than two or three centres of

population, and more often than not, even in those centres that are reported in most detail, make no attempt at estimating the losses. When such estimates are included in the news report, the figures are spectacular: \$150,000 at Hanover in 1926; and \$100,000 at Mildmay in 1929; and \$75,000 at Neustadt in 1929. In the face of the known range of variation of the severity of floods, it is not possible to use the estimates of losses in two floods in three places as a basis for estimating the total losses in thirty-six floods over the entire watershed. One thing seems clear: that even in the worst years of flood, the published figures do not include all the losses incurred. In other words, even in those years when spectacular losses have been announced, the actual totals of the losses caused by the floods have been in excess of the published amounts.

CHAPTER 3

ENCROACHMENTS

Encroachments include any works of man which are built on the natural flood channel of a river. These flood channels may not be used by the river for several years, but at certain intervals, due to excessive precipitation and other factors, this supplementary channel which it has created for itself will most certainly be flooded, because it must be remembered that flooding is a natural phenomenon of rivers.

In the process of settling a new country, encroachments are often unavoidable because, as is well known, many of our towns and cities were established by the erection of a mill on the river or at the junction of a small stream with a larger one. Gradually as time went on, other businesses followed, shopping districts were built up and spread out around this nucleus of settlement. Thus it happens that such towns, or the older part of them at least, are completely within the flood channel, and when high water occurs, they, of course, are flooded.

The presence of encroachments such as narrow bridges with abutments projecting out into the river valley, factories, buildings and so forth, not only aggravates the flood situation from the standpoint of preventing the free passage of water but also by causing ice jams. The ice, which naturally floats on the crest of the stream in the spring, accumulates behind these structures and creates a dangerous dam which may break when the pressure becomes too great or the temperature moderates. These encroachments, together with the gradual denudation of the forest, especially at the headwaters of the rivers, have aggravated the flood situation on most of our streams in Southern Ontario, and it is largely due to these causes that some major works must be undertaken, chiefly in the building of dams or dikes, in order to protect the towns and cities which occupy the river channel in whole or in part at certain points on its course.

Therefore, one of the chief concerns of an Authority in planning a long-term program for the river valley should be to control and check further encroachments on the river, especially where they are costly permanent structures and will involve the loss of property, goods and human life.

CHAPTER 4

UNDERGROUND WATER

*No consideration of river valley development, or of conservation, or of re-development of agricultural areas, would be adequate or in any way complete without some mention of that water which occurs beneath the surface of the earth, and particularly of that part of the subsurface water that is within the zone of saturation, the ground water. For it is this water that is primarily responsible for the continued flow of surface streams and that supplies, to a very great extent, our domestic and industrial needs.

The water of the earth may be divided into three:

- (a) Water in the atmosphere;
- (b) Water on the surface of the earth;
- (c) Water below the surface of the earth.

The water below the surface may in turn be divided into three:

- (1) That above the zone of saturation;
- (2) That in the zone of saturation;
- (3) That in the interior of the earth.

The water in the atmosphere is perhaps primarily the concern of the meteorologist; that on the surface, of the hydraulic engineer; but that below the surface is directly the concern of the geologist, the agriculturalist, and the engineer.

There is, in general, an upper limit within the earth's crust below which the permeable rocks are saturated; this upper limit is called the water table and it forms the surface of the zone of saturation. The water within this zone is the ground water.

Practically all the water recovered from the zone of saturation, that is, ground water, is derived from the atmosphere. Most of it reaches the earth in the form of precipitation, either as rain or snow. Of the precipitation falling on the ground, part is immediately carried away by streams as surface run-off, part evaporates, either directly from the surface and from the upper mantle of soil, or by transpiration of plants, and the remainder sinks into the ground, ultimately to be added to the ground-water supplies.

The proportion of the total precipitation that sinks into the ground will depend largely upon the type of soil or surface rock and the topography of the area upon which the moisture falls; if the surface deposits are of sand or gravel more water will sink in than if those deposits were of clay; if the region is hilly and dissected by numerous valleys more water will immediately drain away than if the surface is fairly flat and but little dissected. Steady precipitation over considerable periods will furnish more water to the ground-water supply than will torrential rains; in this case the run-off may be nearly equal to the total precipitation. Moisture falling after the ground surface is frozen will not usually find its way below the surface and therefore will not materially replenish

*Caley, J. F. Underground Water Supplies. Department of Planning and Development Report, 1945.

the ground-water supply. Light rains falling during the growing season may be wholly absorbed by plants. The quantity of moisture lost by direct evaporation depends largely upon temperature, wind and humidity.

It is evident, then, that the percentage of the total precipitation disposed of by run-off, evaporation, or percolation below the surface is difficult to determine and depends to some extent upon local factors.

That part of the precipitation that sinks into the ground finds its way downward until it reaches the ground-water level or until it comes into contact with a layer of rock which is impervious to its passage; such a layer may hold water some distance above the general ground-water level. This is known as perched water. If the ground-water level is at or near the surface there will be a lake or swamp; if it is cut by a valley, there will be a stream.

The conditions under which ground water occurs and the factors determining its quantity, quality, and possible recovery are many. This water is directly associated with the rock into which it percolates and as this rock may (and in south-western Ontario does) vary in its physical properties from place to place, so will the conditions affecting the ground water change.

Because of the large quantities of water that are daily consumed from underground sources, it may be thought that precipitation cannot furnish the entire supply. However, when it is remembered that a layer of water one inch deep over an area of one square mile amounts to about 14,520,000 imperial gallons and that in south-western Ontario the annual precipitation is perhaps in the order of 30 inches, it will be seen that over 420,000,000 gallons fall on each square mile each year. If we estimate that only 10 to 20 per cent (surely a conservative estimate) of the annual precipitation reaches the zone of saturation, there is still an appreciable quantity of water available to recharge the ground-water supplies.

It is not implied that the ground-water supplies are inexhaustible. So long as the annual recharge, that is the quantity of water reaching the zone of saturation, is equal to or greater than the quantity withdrawn, the ground-water supplies will not materially decline. Unfortunately, however, there are parts of south-western Ontario where this condition does not prevail. It is common knowledge that once permanent streams are now dry, that many springs have disappeared and many wells have failed. Such a condition is in large measure the result of cutting down of forest trees, draining of swamps, and bringing into cultivation areas that perhaps should have been left as woodlots. In general, the same quantity of moisture is falling now as before the streams ceased flowing, but so far as ground water is concerned one of the most important results of the aforementioned conditions is the great increase in surface run-off, culminating all too often in disastrous floods and reducing greatly the quantity of water that formerly went to recharge the subsurface supplies. Couple with this the increase in population with its ever-increasing demand upon ground water for both domestic and industrial needs, and it is not difficult to see that the ground-water resources will still further decline unless some remedial measures are taken.

Getting back to the geology of ground water; all sedimentary rocks are to some degree porous, that is, they possess pores between the individual grains

of which they are composed. Water stored within the rocks mainly occurs as filling these spaces. A very fine-grained rock containing water may have such small pores that the attraction between the rock and water is great enough to hold the water in the rock; such a rock will not yield its water to wells. Those rocks that yield their water readily are called aquifers; those that do not are impervious beds.

For the present purpose the geology of south-western Ontario may be divided into two parts: the bedrock and the overlying unconsolidated glacial deposits.

The bedrock consists of layers of limestone, shale and sandstone that, when viewed at an isolated outcrop, generally appear to be flat-lying, but that regionally are known to dip from 10 to perhaps 40 or 50 feet a mile in a general south-westerly direction. These rocks are sedimentary in origin, having been formed from sediments deposited in bodies of sea water later to be consolidated into hard rock.

The water-bearing properties of the various types of rock constituting this sedimentary succession vary greatly. In general, the shales, being fine-grained, are the poorest aquifers, while the sandstones and limestones are considerably better.

No special study of the water in these rocks has been made, but they have been mapped over much of south-western Ontario so that the distribution, thickness, and general physical characters of the several formations are fairly well known. In the area bordering Lake Erie, the bedrock has been penetrated to various depths by wells drilled for oil and gas, and a study of these drilling records has yielded some general data regarding water. Thus it is that we know of occurrences of fresh water generally in the upper part of the bedrock; of sulphur water somewhat lower; and of salt water at still lower depths.

Overlying the bedrock is the glacial drift. During the final stages of geological history great accumulations of ice formed at several centres in Northern Canada. Due to the pressure exerted by the immense thickness of ice, the ice moved out in all directions from these centres, covering large areas with a continental ice sheet. As the ice advanced it picked up great quantities of loose rock which it carried along and which was deposited when the ice finally retreated by melting. This material is unconsolidated and called glacial drift. Several advances and retreats of the ice sheet took place and each retreat left its accumulation of drift on the surface over which it passed.

Thus, over most of south-western Ontario the bedrock is covered with drift ranging in thickness from zero in parts of the Bruce Peninsula to over 600 feet in the region north of Toronto.

Generally, the drift consists of boulders and pebbles of various composition and size embedded in a matrix of clay to form a more or less impervious mass called boulder clay. Intermingled with this, and commonly in a most complex manner, and also lying above, below, and between successive tillsheets are beds, lenses and pockets of waterlaid sand and gravel which form the chief water-bearing members of the drift.

Throughout the greater part of south-western Ontario most of the ground-water supplies are directly associated with the glacial drift.

CHAPTER 5

GENERAL HYDRAULIC PROBLEMS

Hydraulics as applied to conservation deals with the measurement and control of run-off from river drainage basins. Measurement has to do with such factors as precipitation—both rain and snow—the topography and vegetative covering of the area and the daily gauging of the flow of the river at selected points. Control deals with the prevention of floods by the use of reservoirs and other structures, and the increase of summer flow.

Floods which are caused by the natural run-off from river basins have occurred from time to time in Southern Ontario ever since records were first kept. Evidence of these can be found in diaries going back well over 150 years and from newspaper records for at least 100 years. Most of this run-off occurs in the spring, with the result that there is too much water in our rivers at the time of the year when it is needed least and very little, if any, during midsummer when it is required most. In addition to the flooding which is caused by spring run-off, occasional floods also occur during the summer on watersheds which have little natural protection. These summer floods do serious damage to crops. Such floods are not confined to a few of our largest rivers, but records show that all rivers of any consequence have from time to time caused serious damage in this way.

When Ontario was mostly covered with forest and the natural reservoirs, such as large swamps, had not been interfered with, severe flooding probably was not as frequent as it is today because these two factors had a regulating effect on the flow of water. Land clearing and drainage were necessary to open up the country for agriculture, but in some respects these were carried beyond the point of necessity, thereby aggravating the flood situation. In order now to regain a more or less stable condition of the rivers and streams, certain conservation measures must be carried out, such as the reclaiming of large swamps and water storage areas, the reforestation of marginal and sub-marginal land, and also a program of proper land use as indicated by farm planning, whereby run-off from gently sloping land can be controlled by such methods as contour cultivation and grass land where such is indicated. Such methods aim to control water where it falls on the land. If this could always be done it would be the ideal solution of the flood problem. But to minimize the required flood storage in a large watershed, a program of improved land use would need the co-operation of a great many individual farmers. This would take many years to accomplish. More immediate measures are therefore also necessary, especially where urban centres are frequently flooded.

One of the first problems facing the hydraulic engineer is to estimate or measure the run-off from a drainage basin which causes flooding farther down the valley. This includes a careful examination of rainfall over the years at different times of the year, which in turn presupposes that weather stations

have been established in the area. Topography, types of soil, the amount of vegetative covering, particularly tree growth, on the area, and the gradient of the river, which has a bearing on the rapidity with which the water travels to the river's mouth, must all be carefully studied. If no gauging stations have been established then the run-off must be computed by taking the above factors into consideration and an approximate figure of flow is then determined by comparison with a neighbouring drainage basin which has gauge records in order to decide how much protection by the use of reservoirs is required. If, on the other hand, gauges have been established, by which a daily record is kept of the amount of water going down the channel at certain points, then a more accurate determination can be made of how much protection is needed. Fortunately, at Walkerton and Port Elgin on the Main Saugeen, there are hydrometric records dating from 1914.

After the amount of run-off has been measured by whichever means are available to the engineer, it will give him a figure of flow which will indicate how much of this water will have to be held back by different methods in order to give the necessary protection where flooding is taking place. This means that a reconnaissance survey of the whole watershed must be made in order that suitable valleys be selected where dams can be built for the storing of the required amount of water. When more than a sufficient number of such reservoir sites have been selected, each must be measured as to its capacity, and the required number chosen to hold back sufficient water to solve the flood problem. In addition, wherever a dam is to be built, some subsurface exploratory work must be done at the site to make certain that the dam will have a proper foundation. Only after this preliminary work has been carried out can the reservoirs be finally chosen, the actual designing of the dam structures undertaken and the work carried through to completion.

While conservation reservoirs are usually built for the purpose of preventing floods, they are needed just as much in Southern Ontario for increasing summer flow. This has become increasingly important in recent years because rivers with extreme low flow and those which dry up entirely are a health menace to the communities through which they pass. Summer flow is necessary for flushing out the channel; to furnish water for industrial plants; for the practice of good agriculture; and is absolutely necessary for dilution where urban municipalities empty the effluent of their sewage disposal plants or raw sewage into the river.

The building of dams for the prevention of flooding and the increasing of summer flow is a comparatively new concept in engineering. It is only since the turn of the century that structures of this kind have been used for this purpose in North America. The older methods included such projects as the straightening, widening and deepening of the channels of the rivers, and the removal or improvement of narrow bridges and other man-made works which might obstruct the flow or cause ice jams. Also, occasionally, for such work a river was diverted into another watershed, or dikes were built to hold it within its banks. Such practices are aimed at one thing only, namely to get rid of water as quickly as possible. They do not take into consideration the necessity of holding water at the headwaters for deep infiltration or retaining it for summer flow throughout the year. On some rivers in Ontario channel

improvements, diversions and even dikes must be carried out and built, especially where dams and reservoirs are not economical and summer flow is not a major problem.

CHAPTER 6

HYDRAULICS AND CONTROL MEASURES

1. MEASUREMENT OF RUN-OFF

Run-off is measured by installing gauges (rods graduated in feet and hundredths of a foot) in the river at strategic points. They are rated and the rate of flow in the river at the gauge is known in cubic feet per second (c.f.s.) for any reading or elevation of the gauge. The gauges may be either automatic, producing on graph paper a continuous record of flow, or staff gauges, which are read by an attendant twice daily, and oftener during flood periods or heavy storms.

The Dominion Government installs and administers the gauges and publishes their records. The records show the mean daily or average flow for each day, the mean monthly or average flow for the month, and the maximum and minimum mean daily flows for each month. During flood periods staff gauges are usually not only read at frequent intervals but the peak flow or highest stage is also recorded.

There are two staff gauges installed on the Main Saugeen, dating from 1914: "Walkerton", located on a highway bridge four miles up stream, and the other, called "Port Elgin", located on a highway bridge $3\frac{1}{2}$ miles north-east of Port Elgin and six miles up stream from Southampton. Gauges were also installed at Markdale and Traverston on the Rocky Saugeen and on the Teeswater above Paisley, but were discontinued after a few years of operation.

2. HYDROGRAPHS

The Hydrograph is a correct expression of the detailed run-off of a stream, resulting from all the varying physical conditions which have occurred on the drainage area above the gauging station before the time which it represents.*

The vertical measurements represent the flow in c.f.s., the horizontal measurements the time, and the area below the hydrograph the volume of flow for any given time. It is by means of the hydrograph that the volume of storage in reservoirs is determined, it being approximately the area above a "channel capacity" flow line, or the rate of flow at the stage when the river overflows its banks. These channel capacity tests have not been made yet.

3. CONTROL MEASURES

Most of the rivers in Southern Ontario have a low summer flow problem as well as a flood problem. In order to satisfy the former problem, it is necessary to build dams and impound part of the spring run-off in reservoirs, which is subsequently released to increase the low flows. Although a monthly mean flow as low as 50 c.f.s. was recorded at the Walkerton gauge for September, 1914,

*Definition given in "Hydrology" by Professor D. W. Mead.

the average monthly mean for 37 years of records for September, the month of lowest flow, was 186 c.f.s., and for the other summer months, June 374 c.f.s., July 262 c.f.s. and August 203 c.f.s.

Suitable reservoir sites are available to control flooding on all seriously threatened parts of the watershed, with the exception of Durham and possibly Chepstow. It is believed, however, that the less expensive methods of channel improvement and dike construction should be used before any large-scale building of dams and reservoirs is undertaken.

CHAPTER 7

FLOOD CONTROL FOR THE TOWN OF WALKERTON*

1. INTRODUCTION

The drainage basin of the Saugeen River is comprised mostly of rolling farm lands except at the upper reaches where the watershed is rugged, and well forested. The river valley consists of river flats or flood plains bordered by high clay cliffs. The valley bottom acts as a natural flood plain in times of spring freshet; and towns, such as Walkerton and many others in Ontario, which in the early days were founded on these lands, constitute an encroachment on the natural flood channel and are consequently subject to flooding. This situation has been aggravated by the increase in size and frequency of river flooding due to the development of drainage systems and the clearing of the land.

Between the headwaters of the Main Branch of the river and the river channel at Walkerton, there is a difference in elevation of 900 feet in a distance of 64 miles. This is equivalent to an average gradient of 14 feet per mile. The elevation differential from Durham to Walkerton is 300 feet or approximately 11 feet per mile. Between Walkerton and a point 4 miles down stream the differential is only 20 feet or a gradient of 5 feet per mile; and a point 12 miles down stream is 70 feet lower than Walkerton, which is equivalent to an average grade of 6 feet per mile.

The flattening out of the river gradient below Walkerton contributes greatly to the conditions which cause flooding.

The flood flow for the year 1947 has been slightly exceeded once only during the period in which records were kept—1914-1951. This maximum flood flow which is estimated to be 25,000 c.f.s. is, therefore, used as the design flow.

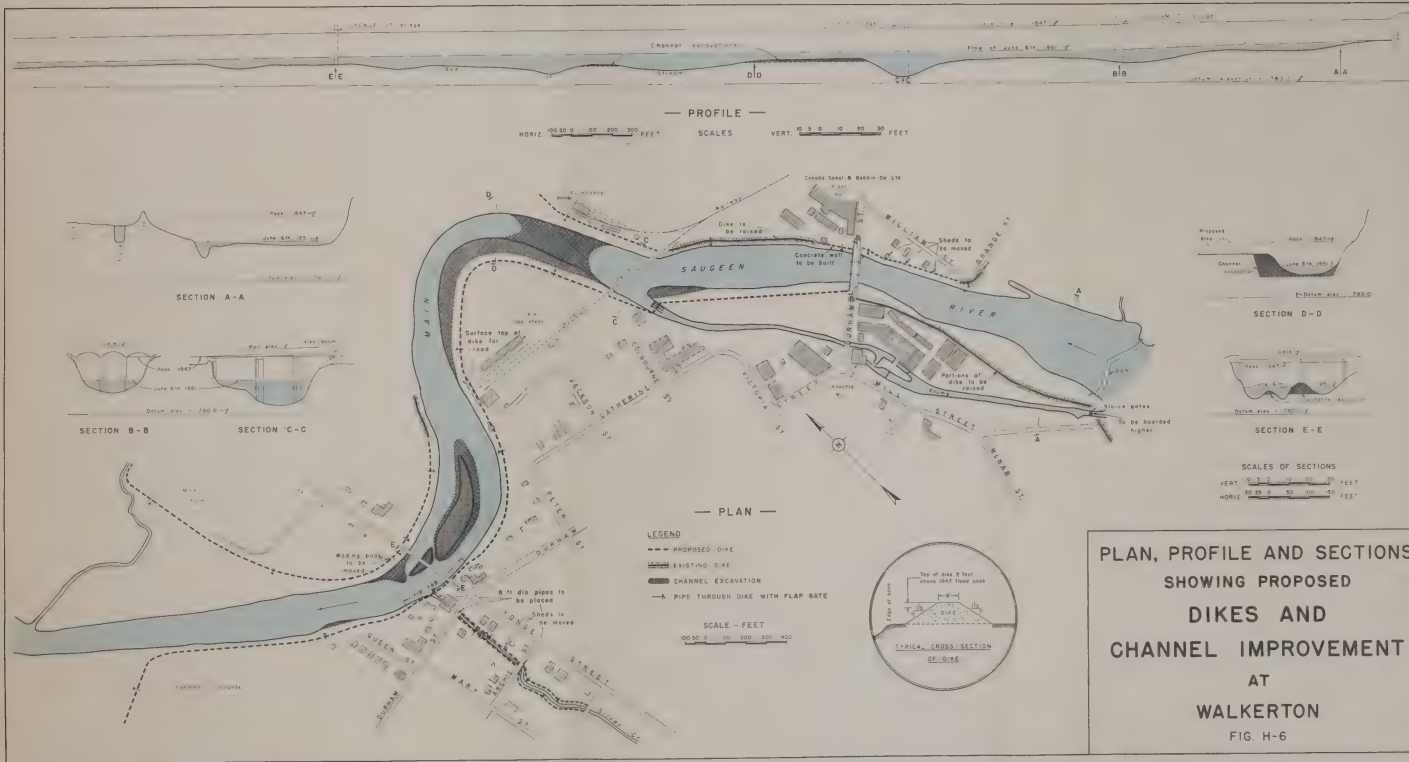
The problem to be solved is to determine the most feasible method of controlling the flood flows of the Saugeen River at Walkerton so that property losses due to flooding may be prevented.

2. METHODS OF SOLVING FLOOD PROBLEMS

Excessive river flooding can be reduced or prevented entirely by one or a combination of several of the following methods:

- (a) Storage reservoirs for the purpose of impounding water during the periods of high run-off and later release during the dry season.

*From a report prepared by the Kilborn Engineering Company Limited of Toronto.



There is no doubt that prevention of flooding by the use of flood control reservoirs is superior to other methods because the benefits extend to other flood-menaced communities lower on the river and the waters so impounded may be used to great advantage in increasing river flows during the drier times of the season. However, as the other more immediate schemes are designed to handle the greatest flood on record in Walkerton, a long-term plan for the whole watershed including reservoirs will have to wait for future surveys.

- (b) A second method is by river channel improvement, including enlarging the channel, removing obstructions and restrictions and improving the grade, so that the peak flows may be contained within the normal banks of the river.

As the gradient of the Saugeen River during flood periods below the Yonge Street bridge at Walkerton is very flat, the water can be lowered only slightly by improving the river channel. Any improvement above the bridge would be of little avail as the flood waters would still be too high to eliminate the necessity of storage reservoirs or diking.

However, a large percentage of the flood flow passes over the river flats or flood plains along its course, so when these flats are cut off by diking, some river channel improvement must be instituted to accommodate this water. Therefore, at Walkerton widening and deepening of the channel must be carried out from a point above the C.P.R. bridge to below the Yonge Street bridge, if diking is to be effective.

- (c) A third method is by constructing dikes along the banks of the river so that the peak flows expected may be prevented from inundating surrounding lands.

A diking scheme to prevent a flood, equal to the 1947 peak, from inundating part of the town of Walkerton is feasible when combined with the channel improvement. Such a scheme would necessitate about 3,500 feet of diking on the north side of the river and 7,100 feet of diking on the south side.

- (d) A fourth method is the building of a diversion canal, excavated to an adequate size to by-pass the excess water around the area to be protected, in this case the town of Walkerton.

The topographical map of the area was examined with a view to locating a route along which a channel might be constructed to divert or by-pass flood waters around Walkerton. Owing to the high relief of the district, it was evident that the cost of such a channel would be exorbitant, and no further investigation of this method of flood control was made.

3. THE SOLUTION OF THE FLOOD PROBLEM IN WALKERTON

Diking of the river, combined with certain channel improvements, is a feasible method of flood control for the town of Walkerton.

The program of construction recommended by this report is based on channeling through Walkerton a peak flow of 25,000 cubic feet per second, which represents the calculated peak flow of the 1947 flood.

Improvements to the channel, mentioned above, will be necessary from above the C.P.R. bridge to below the Yonge Street bridge.

Dikes would have to be constructed in the following locations:

- (1) From the Exhibition Grounds to Yonge Street bridge, a distance of approximately 1,900 feet along the south side of the river;
- (2) Around Silver Creek, a distance of approximately 1,700 feet including both banks of the creek;
- (3) From Mink Farm to the Yonge Street bridge, a distance of approximately 1,600 feet on the north side of the river;
- (4) From Yonge Street bridge to high ground, a distance of approximately 600 feet on the north side of the river;
- (5) From the Yonge Street bridge to the C.P.R. bridge, a distance of approximately 2,300 feet on the south side of the river;
- (6) From the C.P.R. bridge to Durham Street bridge, a distance of approximately 1,200 feet on the south side of the river;
- (7) From high ground to the C.P.R. bridge, a distance of approximately 600 feet on the north side of the river;
- (8) From Durham Street bridge to the corner of William and Orange Streets, a distance of approximately 700 feet on the north side of the river.

The cost of these works including diking, appurtenant works, channel improvement, purchase of land and moving buildings and other necessary items is estimated to be \$169,360.00.

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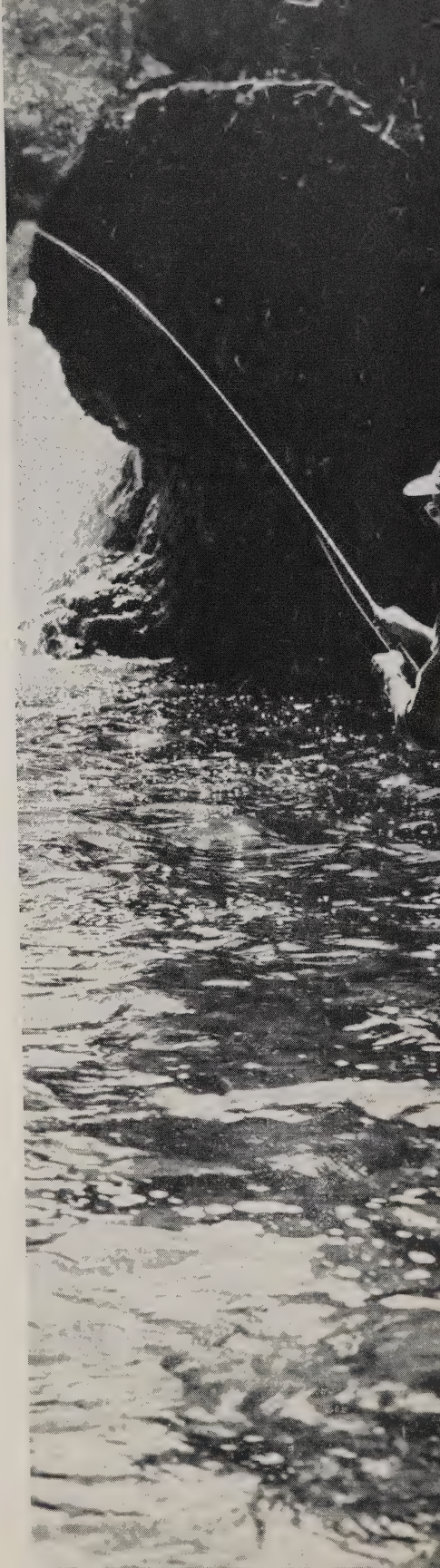
WILDLIFE

CHAPTER 1

INTRODUCTION

Land well adapted for fish and wildlife should produce or harbour a permanent population of interesting and useful species and an annual crop of fish, game and fur. These populations should be adapted in agricultural land so that they have no adverse effect on all reasonable farming practices. The control of harmful species and the maintenance of all other animal populations at a desirable level, through the provision of a proper "habitat" or living quarters, is a natural branch of good land management.

The maintenance of the proper balance between the numbers of the various species can be achieved in many ways. Many species if left undisturbed will help to control others which are not wanted. The hawk which preys on destructive meadow mice in an orchard is



worth many dollars to the farmer who protects it. This type of management has been much neglected in Canada. The traditional methods of game and fish management have included restrictions of the daily and seasonal kill and of the method of kill, predator control, reservations of game lands and artificial restocking. The provision of a proper habitat is often more important than all of these.

Wildlife planning thus requires a study of the existing habitat and a study of the wildlife populations, particularly the dynamics or changes of populations over a period of several seasons. The second requirement cannot be carried out in a rapid survey. Moreover a beginning has only recently been made in the basic research on game environments in Southern Ontario. The techniques of stream surveys are farther advanced. The Saugeen River has long been one of the more important fishing streams of Southern Ontario. The field work was therefore concentrated chiefly on the condition of the river and its suitability for fish.

CHAPTER 2

PRESENT SPECIES

1. GAME

No detailed study of the populations of any of the game species was made during the survey. There is little territory suitable for breeding wild ducks in the watershed. Common snipe are also scarce. Much of the lower lands appeared to provide suitable ground for woodcock, although few were met with during the summer. The watershed was examined and mapped as suitable or unsuitable territory respectively for deer, ruffed grouse and the European hare, the three chief game species occurring. Apart from the flat and poorly drained sector in and around Osprey Township, the watershed as a whole is remarkably homogeneous, providing very diverse conditions in every township examined. The map of game habitats is available for reference.

2. BIRDS

The part of the Saugeen Watershed examined lies close to one of the main migration flyways of North America. It includes most types of habitat for birds, although large lakes and extensive beaches are absent and wide mudflats are rare. There are probably 250-275 different kinds of birds which either live in or migrate through the watershed every year. A list of these species would be largely hypothetical, since most of the early migrants and winter visitors were not seen during the 1951 survey, but 141 species were observed by two members of the party during the summer. Twenty-five of these species were migrants. The remaining 116 are listed in the full report. These include almost all the birds which may be expected to be found in the watershed in summer.

CHAPTER 3

IMPROVING THE FARM FOR WILDLIFE

The present survey did not include detailed work on farm or forest wildlife. There are many varied types of land in the watershed. The requirements of

food and cover vary greatly for the different species of wildlife. The recommendations here listed are therefore those which can be most generally applied by the landowner.

1. WOODLANDS

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Large-scale reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will therefore come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas, and who wish to produce a proper environment for wildlife, will find that release cuttings, slashings to stimulate sprout growth, thinnings and felling timber for sale will improve rather than retard the carrying capacity for wildlife. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

2. CULTIVATION PRACTICES

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive area is denuded of cover at one time by harvesting. In the less flat parts of the watershed, filter strips, either above water-diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now becoming more common on the Saugeen Watershed. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. *Rosa multiflora* is an excellent hedge-forming shrub. It has a tendency in Southern Ontario to die back in winter, but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground. However, in view of its questionable hardiness it should not be planted on the Saugeen Watershed without consultation with the nearest biologist or forester of the Department of Lands and Forests.

3. COVER PATCHES

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four fields may be made into a haven for ground-nesting species by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation, which is bluegrass.

4. PONDS AND STREAMS

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible, ponds for wildlife should be separate from those intended for cattle or for fish. Willow cuttings pushed in the ground around such a hollow will rapidly provide wildlife cover. New water areas will soon be invaded by aquatic plants, but additional species may have to be introduced. No extensive duck food studies have been made in Southern Ontario. Wild rice may be introduced, but since it is not well adapted to wide variations in water levels, being often sterile in fluctuating waters, it cannot be considered as certain to succeed. The idea has long been current, and fostered by many sportsmen's organizations, that the planting of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of little significance to ducks in Canada except in the fall, and does not provide good cover or nesting sites. The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they can be introduced.

Sago Pondweed.....	<i>Potamogeton pectinatus</i> L.
Red-head Pondweed...	<i>Potamogeton Richardsonii</i> (Ar. Benn.) Rydb.
Wild Millet.....	<i>Echinochloa crusgalli</i> (L) Beauv.
Japanese Millet.....	<i>Echinochloa frumentacea</i> (Roxb.) Link
Wild Celery.....	<i>Vallisneria americana</i> Michx.
Knotweed.....	<i>Polygonum pennsylvanicum</i> L.
Water Smartweed....	<i>Polygonum coccineum</i> Muhl.
Three-square.....	<i>Scirpus americanus</i> Pers.
Great Bulrush.....	<i>Scirpus validus</i> Vahl., var. <i>creber</i> Fern.

Those who are interested in farm ponds for wildlife will find very useful details of the various types of pond and methods for constructing each type in the bulletin on farm ponds, distributed by the Secretary of the Authority. Farm ponds differ from those intended for wildlife in that care is usually taken to prevent the growth of aquatic vegetation in a farm pond intended only for watering stock or fire protection purposes. Otherwise the construction and details of ponds for wildlife should follow one of the types there described.

CHAPTER 4

FISH

The purpose of this survey was to make a preliminary examination of the waters of the drainage basin and to classify them as to their present suitability for fish, and secondly, to make recommendations for possible improvements.

The Rocky Saugeen near Markdale has excellent cover from logs and debris and is well shaded. Here also the river bottom is remarkably even in depth.



This log jam on the Rocky Saugeen in Glenelg Township tends to block the movement of fish up and down the stream, but it also provides excellent fish cover.



The gorge of the Rocky Saugeen below Hayward Falls in Glenelg Township provides spectacular scenery and easy fly fishing but lacks good holes and fish cover.



1. METHODS

The river and its tributaries were visited at 225 "stations", most of them at road crossings. The stations were from half a mile to three miles apart on each stream course. The topographic features of the valley and the erosion, vegetation, volume of flow, turbidity, temperature and type of bottom were listed for each station. At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made. The classification of these collections forms the chief basis for the map "Biological Conditions of Streams" in the full report. The aquatic insects such as mayflies, stoneflies and caddisflies were most useful for this purpose, since many of them are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and clear in summer, such as trout waters. Others are indicators of permanent flow or of polluted water or of the maximum summer temperature of the water. Thus the potentialities of a stream for particular species of fish are indicated. The fish collections substantiated these findings at their particular stations.

The procedure here adopted follows that used in previous river surveys by the Department of Planning and Development and allows close comparisons of the characteristics of many rivers. The present criteria and methods evolved from more intensive year-round research carried out by Dr. F. P. Ide on parts of the Nottawasaga River and Algonquin Park streams, already reported on, and from other unpublished research data made available for this work.

The great majority of the stations could be examined only once during the summer. It was therefore necessary to rely on deductions made from the presence or absence of species which extensive previous tests have shown to be reliable indicators.

Maximum and minimum recording thermometers were installed in the water at eight stations, from June 15 to September 3, 1951. Temperatures were recorded and the thermometers reset every two days.

2. THE RIVER VALLEY

The area of the valley examined in 1951 constitutes the central section of the headwaters of the Saugeen River. The Main Saugeen rises in the silty plain north of Dundalk. Drainage is poor and this part of the river is sluggish, with several small and much-ditched tributaries. Apart from this section the streams flow chiefly through sandy and gravelly deposits overlying the limestone bedrock. Only the larger streams have cut through to the bedrock itself.

Most of the streams follow the lines of former glacial meltwater channels or spillways and cut indiscriminately across the earlier glacial landforms. A few of the streams start their courses from residual lakes, but most begin in swamplands, which are spring-fed in many places. The streams wending their way from swamplands are remarkably clear, with occasional falls and rapids. The upper part of the Main Saugeen and the lower part of the Styx River are the chief sections which exhibit meanders and the beginnings of oxbows.

The gravelly hills (in the east and south of Glenelg Township and in Egremont and the south part of Bentinck Township) have few good springs in the

hillsides. The waters percolate down to the swampy flats which surround these hills and there flow out as sluggish streams. More springs are found in the whaleback hills in central Bentinck Township.

Small residual lakes are common in the part of the watershed examined. Most of them were larger in earlier post-glacial times and are still gradually decreasing in size. Many of the larger ones are located in the floors of glacial spillways, and these, as a rule, have surface outlets, but most of the smaller ones are found in hollows within the moraines and lack surface outlets.

3. PERMANENCE OF FLOW

The permanence of flow of the various branches and tributaries is shown on the map "Biological Conditions of Streams", which accompanies the full report.* Very few of the watercourses dry up completely in summer.

The flow gauge nearest to the area examined is at Walkerton, and the flow there, measured daily, includes the South Saugeen, Beatty Saugeen and some smaller tributaries, in addition to the flow from the area examined. A comparison of the minimum daily flows for the years 1914-1951 follows.

	1951	1914-1951	1914-1951
	<i>Minimum Daily Flow</i>	<i>Average of Minimum Daily Flows Recorded</i>	<i>Minimum Daily Flow Recorded</i>
	c.f.s.	c.f.s.	c.f.s.
August.....	193	204	81 (1917)
September.....	208	185	50 (1914)

The flow in the river and its tributaries in 1951 was close to the normal summer flow (180-210 c.f.s.), but vastly greater than the minimum daily flow (50 c.f.s. recorded in September, 1914).

The Rocky Saugeen provides the most important contribution to the whole river in summer (55 c.f.s. recorded in August, 1951).

Camp Creek provides the largest volume in comparison to the area drained (25 c.f.s. or .61 c.f.s. per square mile, estimated in August, 1951).

With one exception, all of the gradients of the rivers examined were steep, varying from 12 to 36 feet per mile. The exception, the Main Saugeen on the Dundalk Plain, still has a gradient of 9 feet per mile.

It is of interest that in the 37 years of records of daily flows of the Saugeen at Walkerton, the four highest daily flows recorded, all over 20,000 c.f.s., have all occurred in the last ten years (1941-1951).

4. TEMPERATURE CONDITIONS

With the exception of one or two tributaries, the Saugeen River from its source down nearly to Hanover is satisfactory trout water as far as temperature is concerned. This is a distance of over forty miles along the longest tributary, a phenomenally extensive trout section. The chief physiographic feature con-

*Copies of this map are available on request, from the Conservation Branch, Department of Planning and Development.

tributing to this condition is the great number of springs, both at the sources and along the courses of most of the tributaries, which supply initially cool water. Many of these springs come from the reservoir in the limestones which slope south-westward from the edge of the escarpment. Others are associated with the Singhampton moraine flanking the northern edge of the watershed and with the gravelly kame moraines prominent in many parts of the watershed. Other contributing conditions include the rapid flow of many of the streams in all but their uppermost sections, and the fact that the well-treed banks shade the water of most of the tributaries. This follows, of course, from the fact that the valleys through which the streams run are to a large extent non-agricultural.

Temperatures unfavourably high for speckled trout in summer occurred in the Main Saugeen below Priceville over a distance of about 15 miles, throughout the lower part of the Styx River, and in the lowest part of the main river as it approaches Hanover. The two first-mentioned sections have a relatively small flow, a low gradient and much open country as compared with other parts of the river.

The lower section of the trout reaches of the Rocky Saugeen has higher mean temperatures than are found in the smaller tributaries suitable for trout. This correlates with the higher rate of growth of the speckled trout in the Rocky Saugeen compared with the growth of those from the smaller tributaries.

5. POLLUTION

The common sources of pollution in Ontario are raw and treated sewage, milk wastes from creameries and cheese factories, various industrial wastes and cattle droppings. None of these appeared to be having a serious effect on the fish life in those parts of the Saugeen River examined.

The effects of cattle using the streams were noted at 51 of 225 stations visited. Milk wastes are discharged daily into Camp Creek at the south end of Durham but the fish life appeared unaffected. Trout were seen feeding on the curd from this effluent. There have been reports that the fish from this branch are not healthy. No evidence was found of such a condition. One small tributary above Priceville had an oil scum and abundant algae, but the condition was local. The cause was not determined.

There is a group of substances such as fibres, sawdust and silt which are not normally considered as pollutants but which may render the river bottom unsuitable for fish or unproductive of bottom fauna. Sawdust rapidly sinks and renders the river bottom relatively sterile. Large quantities of sawdust are washed down the Rocky Saugeen from Traverston, and it could be found as an important component of the river bottom for at least a mile below the sawmill. It could also be seen in the Rocky Saugeen about one mile below Markdale.

6. FISH DISTRIBUTION

Thirty-six species of fish were taken in the rivers and streams of the watershed during the survey. Further collecting or angling would, of course, increase

Fallen trees sometimes block a trout stream so that it spreads out, making a wide, shallow weed-grown section, with good cover but little depth. This tributary enters the Rocky Saugeen from the south near Markdale.



Sawdust enters the Rocky Saugeen from at least two sawmills. It renders the river bottom sterile and also covers gravel spawning beds.

Severe bank erosion is rare on the Rocky Saugeen, but common on the Main River. This eroded bank is on the Main Saugeen below Hanover.



the known range of some of the species. Rainbow trout, for example, were found only at Durham, but the species is also taken in most seasons elsewhere between Durham and Hanover and in the lower part of the Rocky Saugeen.

Speckled trout were found at 99 of 225 stations visited and probably exist at several other stations where they were not found. They were very widely distributed through the watershed. The chief sections in which they were absent included most of the lower part of the Styx River and the part of the Main Saugeen from Priceville to the junction with the Rocky Saugeen. The cooler waters of the Rocky Saugeen improve the Main Saugeen in summer for several miles below the junction. No trout were found between Allan Park and Hanover. No other important game fish occurs in large numbers in the watershed. A few brown trout are taken, chiefly in the Rocky Saugeen. Rainbow trout are also taken at least as far up as Hanover.

The following notes describe the distribution of some of the more interesting kinds of fish encountered. The Michigan brook lamprey was found only in the lower Styx and in the Main Saugeen below Durham. Common suckers were distributed throughout the river except in the upper Rocky Saugeen. The Creek chub appeared to be the commonest and most widely distributed species of fish in the river. Several of the sixteen species of minnows appeared to be restricted in range to the east or west ends of the watershed. Thus the Rosy-face shiner, while not uncommon, was apparently restricted to the parts of the river west of Durham, and the Redside dace was common in all of the waters east of Durham but not found west of the town.

Pike were found only in the Styx River and near Hanover in the main river but are probably more widely distributed. Yellow perch were taken in several small lakes. Of the six species of darters collected, five were found only in the Styx River and the lower parts of the Main Saugeen. The sixth, the Iowa darter, was more widely distributed, though uncommon.

Of the bass family Long-ear sunfish were found in Black's Creek, the upper Styx and Habermehl Creek and were abundant in many of the lakes. Rock bass were found only in two small tributaries.

Of the Sculpin family the muddler was very common in the cooler waters, while the "miller's thumb" was taken only at nine stations in water not above 59° F. when the collections were made.

7. TROUT GROWTH RATES

Trout scales collected during the survey were examined by the Research Division of the Department of Lands and Forests, Maple, along with scales from other Southern Ontario streams for the purpose of determining the rate of growth of the trout.

The results showed, firstly, that the growth rates of speckled trout in various Southern Ontario waters are very similar, and secondly, that the fish in the Rocky Saugeen grow more rapidly than those in its tributaries.

8. TROUT POPULATIONS AND STREAM IMPROVEMENTS

The Saugeen River has long been famous as speckled trout water. Trout are shown by the present survey to be still remarkably well distributed in the



Small trout streams with a rapid fall such as this one in Glenelg Township are usually poor producers of trout, but nevertheless beautiful to visit.

Many of the largest speckled trout caught in Ontario have come from ponded weedy waters similar to this stretch of the Rocky Saugeen in Artemesia Township.



area of the watershed examined. When some allowance is made for the difficulty of catching them when present in small numbers, it seems that almost every section that might be expected to be suitable trout water from the indicator species of bottom fauna and from the temperature records did actually have trout in it at the time of the survey.

But while the trout were remarkably well distributed the fishing success is reported to have declined greatly since twenty or thirty years ago. The sizes of the larger trout taken in most areas and, in many cases, the number of fish of legal size are both reported to be reduced. There is no statistical evidence for this because the fishing effort and the total fishing time have not been measured nor are the fish weighed or measured in those records which are available of fish taken. One might add that there are probably many more people fishing than formerly. If the same legal catch is distributed amongst more people the impression is gained that there are fewer fish in the river. However, those in the best position to compare the present conditions with the former ones were agreed concerning the reduction. There were many reports that the waters now contain large numbers of very small trout but few of legal size.

Little or nothing is known concerning the present trend in the trout population, i.e. whether the numbers of large trout are now stabilized at a low level or whether a further decline or an improvement is taking place. The evidence needed to show the present trend would have to include measurements of the growth rate and survival of the various "year classes" of both the naturally spawned and the introduced fish. It would also have to include the effects of changes in the river bed, and in the water, and the effects of competing fish. All of these and the intensity of fishing would have to be measured over a period of years either in the Saugeen or in some similar river of Southern Ontario to provide really useful material. No such study has been made, except the growth rates described earlier in this report.

The present survey was a reconnaissance survey only. The watershed examined contains more than 200 miles of trout waters, large and small. The survey reports show that the trout waters include almost every possible variation of volume of flow, gradient, depth, bottom and bottom fauna (or fish foods), vegetation, shade, cover and competing fish. The maximum summer temperature of the trout waters also varies from 43° Fahrenheit (in a small stream near Durham) to more than 75° in several sections. The present survey cannot therefore be expected to provide detailed plans for improvements of all the many types of stream.

Many and perhaps most of those who fish the Saugeen and its neighbour streams believe that all that is needed to restore the streams to their former productivity is that more and more trout fingerlings or fry should be introduced into them. The known facts do not substantiate this theory, since even those areas which have been consistently and heavily stocked have failed to produce yields equal to those of former years.

In the absence of any well-ordered data concerning fish populations any recommendations for improvements are subject to error. The effects of the competition furnished by great numbers of creek chub and other small fish,

and of predation by brown trout and the older speckled trout, are little understood. There are, however, certain obvious deficiencies in the habitat for trout in the watershed. Most of the larger stretches of river, i.e. the Rocky Saugeen below Markdale and the lower part of the Main Saugeen suitable for trout, fall far short of the ideal in the amount of cover for trout they afford. Considering their relatively large volume of flow they seem short of good potholes, large boulders with eddies, and submerged logs. Much of the Rocky Saugeen is remarkably even in depth, apart from a short but spectacular stretch below Traverston and the ponds above the seven dams in its course. (The ends of the two log jams of course provide excellent cover.) Owners and lessees of stretches of the river should therefore be encouraged to install low dams and deflectors which will force the stream to dig holes but will not raise the temperature of the water as impoundments do.

There are many small tributaries to which the same remarks apply, for example several of the tributaries of Camp Creek east of Durham and the creek in Artemesia Township which in its lower course supplies Markdale's water. The latter is a good example of the type of stream which has developed several shallow, wide and weedy sections which could easily be narrowed and improved.

Several of the streams in the watershed, notably some parts of the Styx River and the upper Main Saugeen, are lacking in shade. Owners should therefore be encouraged to make stream bank plantings. (Alders or species of willows which do not tend to spread should be chosen for this purpose.) The cooling effect of the trees would thus extend the trout-producing sections of the river.

While the exact effect of the sawdust which enters the river from at least two sawmills is not known, there is little doubt that it is harmful both to the growth and reproduction of fish, since it produces a sterile bottom and covers gravel beds. The Conservation Authority has the necessary powers to see that this abuse of the river is ended.

The normal flow of the Rocky Saugeen north of Durham is much reduced each weekday afternoon to store water for operations of a factory. As the accompanying photographs show, this bares much of the river bed and of course prevents the development of the bottom fauna which would otherwise be found there, besides reducing the cover for trout in the pools that remain. This effect continues far down the river. The gates of the dam should be adjusted so that the flow is reduced as little as possible, so that the pond is just filled at the start of operations next day.

9. OWNERSHIP

A map showing the location of the posted waters as of 1951 accompanies the full report. Most sections of the Rocky Saugeen below Markdale, and the choicer fishing areas on other trout-producing tributaries, are now closed to the public. It can hardly be denied that good trout water, open to the public and within reasonable access from the larger centres of population of Southern Ontario, is rapidly becoming a rarity. In other words the sport of trout fishing in a spectacular river is now almost restricted to those who can afford to pay a

high price for the privilege. Some governments, for example that of New York State, have already taken note of the situation and have acquired stretches of first-class trout rivers so that they will not be lost to the general public. The Rocky Saugeen River, besides its fishing, has also much spectacular scenery and its gorge contains a very interesting flora including some rare species. The Conservation Authority might therefore give attention to the possibility of acquiring or urging the acquisition of some stretch of the river for the public.

The Conservation Authority might also greatly stimulate stream development by sponsoring the improvement of one or more streams, as a demonstration of what can be done, in lands to be acquired by the Authority for reforestation. Alternatively it might urge that such a demonstration be carried out on one of the small streams in the Grey County Forest. These are already trout water, but could be improved, and one of them is very suitable for the purpose.

Owners along the river, either individuals or clubs, could do themselves and the Province a service by establishing a creel census on their property, listing the date, number and size of the catch and the fishing effort (number of rods and duration of fishing in hours), and by making the information available to the Department of Lands and Forests. The information would be of little use unless the records were kept over a period of years.

10. FARM FISH PONDS

There is ample room for improvement of this type of fishing. The chief research on management of farm fish ponds has been carried on in southern and warmer climates, and therefore the findings cannot be applied without qualification to an area having the climate of Southern Ontario, but some definite recommendations may be made.

From the fisherman's point of view, farm ponds are of two main kinds.* The first is the cool pond with continuous inflowing water and maximum temperatures at the surface of about 75° Fahrenheit with cooler bottom. Ponds of this type are usually successful near the headwaters and may range in size from about an acre to 8 or 10 acres. Depth should be 10 feet or more in the deepest part. Spring flow of as low as half a cubic foot per second will maintain a pond of one acre. This type of pond is best adapted to the production of speckled trout or brown trout. These species of trout do not normally reproduce in ponds and must be maintained by periodic restocking. Ponds cold enough for trout should not be stocked with mixed types of fish.

The second and commoner type of farm pond is the warm water pond. Most farms have at least one low spot suitable for a fish pond. It is frequently good practice to have separate ponds devoted to wildlife and fish and to control the aquatic plants in the fish pond.

In managing warm water ponds for fish the following points should be kept in mind.

*An excellent handbook on the details of construction and management of farm fish ponds is "Fish Ponds for the Farm" by F. C. Edminster, published by Charles Scribner's Sons, New York, 1947. Some of the above information is abstracted from this bulletin.



A privately-owned dam and fish ladder, both constructed to improve the stream for speckled trout, on the Rocky Saugeen in Bentinck Township.



Storage of water for factory operations often results in lowered levels below the dams. The upper photograph shows the Rocky Saugeen at 4.15 p.m.; the lower one shows it at 5.00 p.m. on the same day. The reduction of the river lessens the area which can provide bottom fauna (or fish foods), besides reducing the cover for fish.





Boulders placed across the Rocky Saugeen in Glenelg Township have improved the river for speckled trout, but there is still a shortage of deep holes.

This small trout stream in the Grey County Forest lacks depth.



The same stream after five minutes' work with boulders. The dammed section is much deeper, and a good hole is being dug below the boulders.



A minimum depth of 10 feet over at least 25 per cent of the pond should be planned to avoid excessive winter kill, probably the critical factor in fish survival in farm ponds in Ontario.

If suckers, carp or large numbers of minnows are already present in the pond, it is usually best to destroy all fish in the pond before stocking.

It is often necessary to control existing aquatic vegetation. There are both mechanical and chemical methods available.*

There have been few tests made in Ontario of the efficiency of applications of fertilizer in increasing the crop of plankton, the smaller aquatic invertebrates. The research now being carried out in this field may lead to application of fertilizers such as 8-8-4 becoming more general.

Since many of the species commonly recommended for introduction grow very slowly in Ontario waters, research to determine the most satisfactory species in this province will be needed. New ponds and those in which the previous fish have been destroyed might be stocked experimentally with a combination of large-mouth bass (*Huro salmoides*) and bluegills (*Lepomis macrochirus*) at the rate of 100 bass and 1,000 bluegills per acre. Fishing should be deferred until some of each species have spawned successfully.

*Speirs, J. Murray. Summary of Literature on Aquatic Weed Control. Canadian Fish Culturist, 3:(4); August, 1948.

PHOTOGRAPHS

Photographs used in this report were taken by the Department of Planning and Development Conservation Branch, except for the following, permission to use which is gratefully acknowledged:

To the Royal Ontario Museum, for permission to use the portrait of Awbonwaishkum, a Chippewa Chief, as part of the cover design. The original was a painting made by Paul Kane in 1845, in the course of his travels in the Saugeen country, and is in the possession of the Royal Ontario Museum.

To Miss Margaret Hunter, Durham, for permission to use the photograph of the British Hotel. The original of this photograph was a tintype, and reversed, right for left, like a negative. The upright photograph used decoratively on the first page of the Historical Section is made from the same original, corrected by reversing the negative by which the tintype was copied for this report.

To the Durham Furniture Company, for permission to use the photograph of the picnic scene on the site of Dunsmoor's dam.

To the Toronto Globe & Mail, for permission to use the photographs of Durham and Jackson Streets, Walkerton, showing the flood of March 17, 1948.

MAPS

The following large maps are included in the full report and a limited number are available on request:

Recommended Land Use. Map 23 x 36 inches, scale 1 mile to 9/10 inch. Seven colours.

Biological Conditions of Streams. Map 19 x 26½ inches, in two sections, scale 1 mile to 7/10 inch. Four colours.

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"River Valley Development is the wise use of all the natural resources of a river valley for all the people living in the valley, for all time."

- Samuel Woodstock